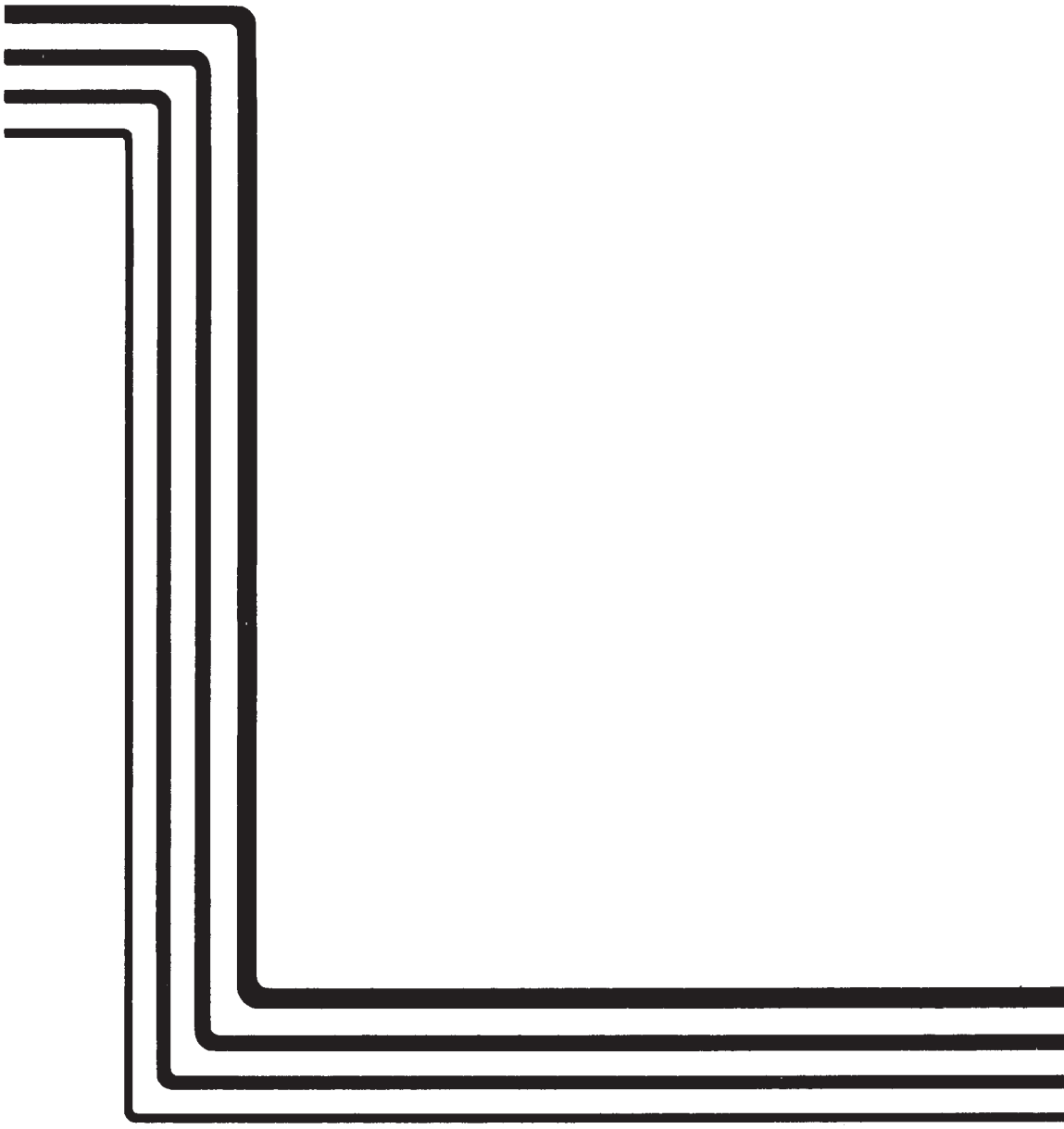
Soil Survey of DENTON COUNTY, TEXAS



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

HOW TO USE

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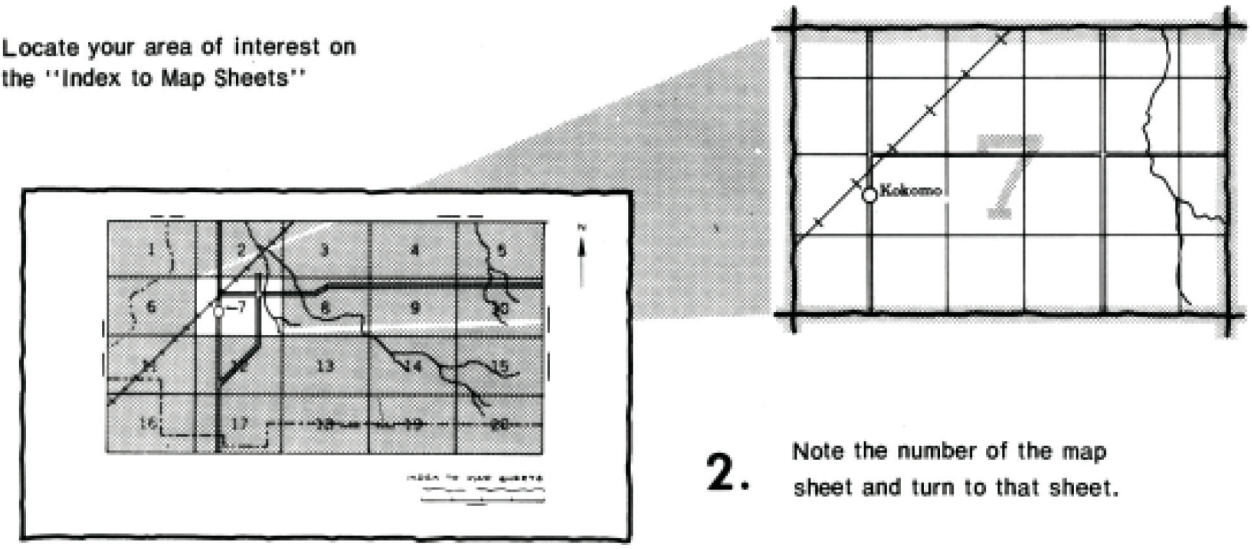

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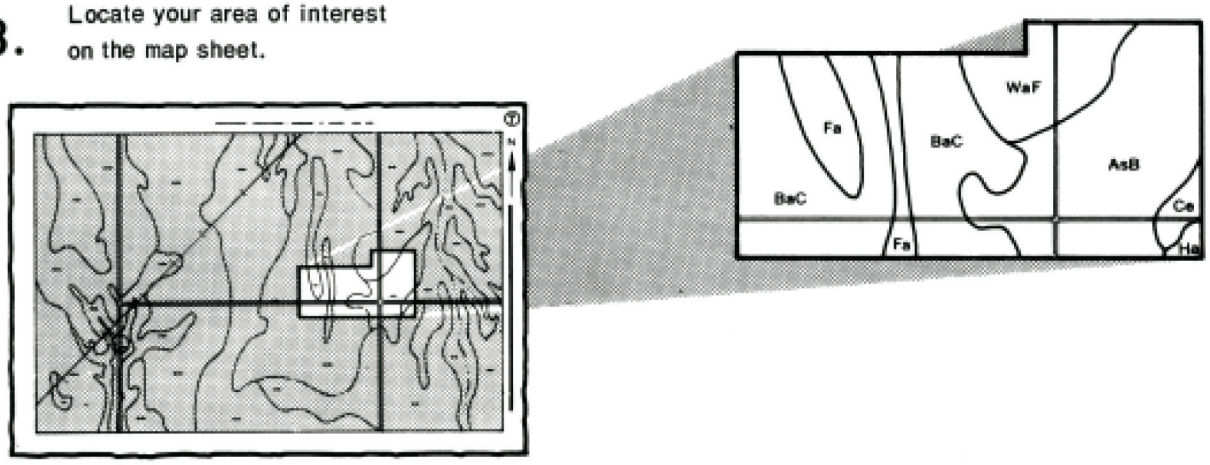

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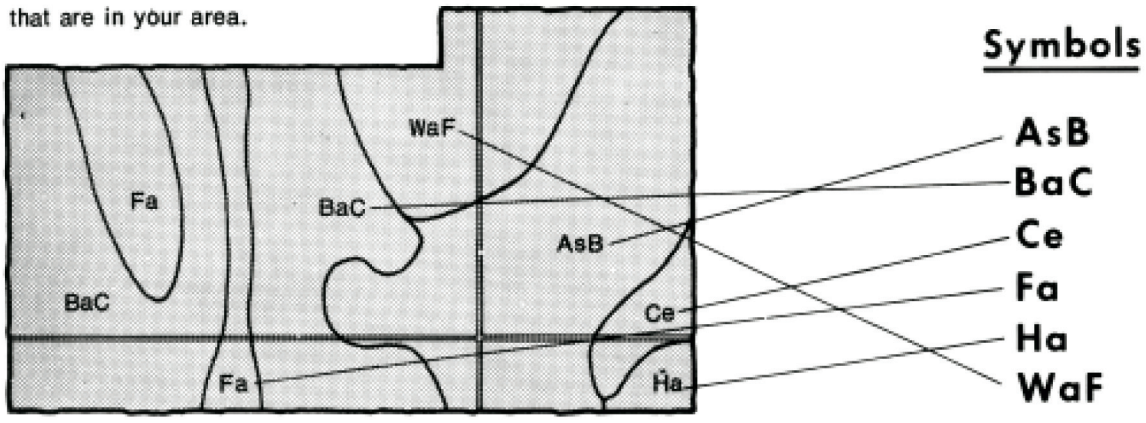
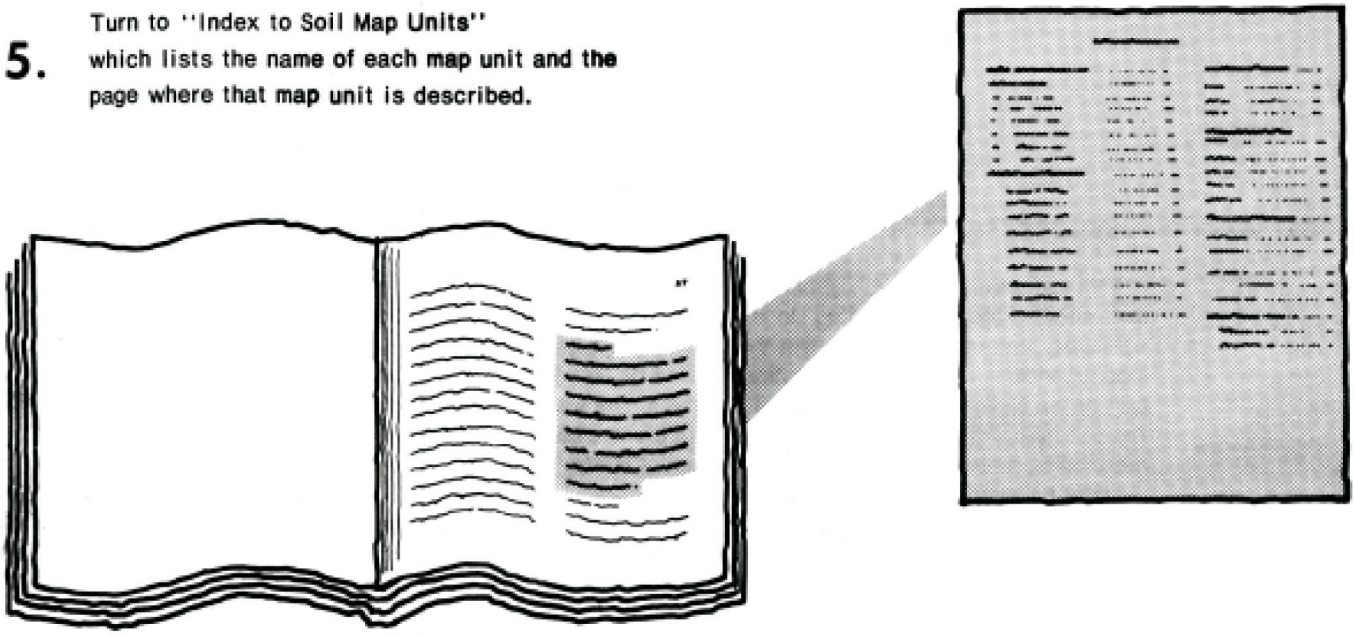
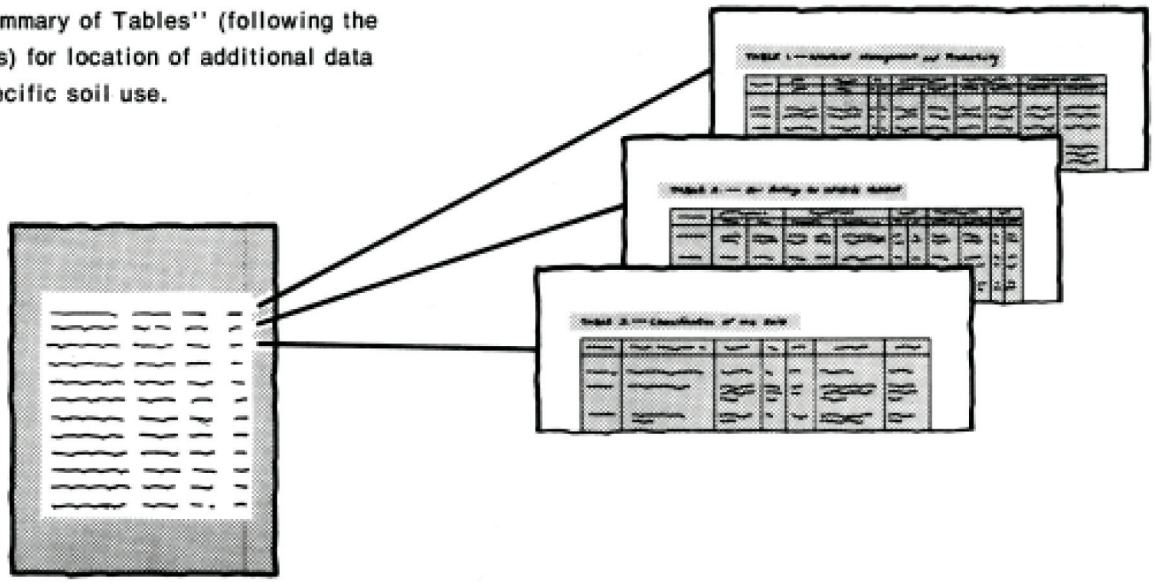


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1967-1975. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Denton Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Contents

	Page
Index to soil map units	iv
Summary of tables	v
Foreword	vii
General nature of the county	1
Settlement and population	1
Natural resources	1
Agriculture	1
Climate	1
How this survey was made	2
General soil map for broad land use planning	2
Moderately deep and deep soils on upland savannahs	3
1. Birome-Gasil-Callisburg	3
Moderately deep and deep soils on upland prairies	4
2. Sanger-Somervell	4
3. Navo-Wilson	4
4. Branyon-Burleson-Heiden	6
5. Altoga-Vertel-Ferris	6
6. Slidell-Sanger	6
7. Ponder-Lindale	7
Deep soils on bottom lands	7
8. Frio-Ovan	7
Very shallow to deep soils on upland prairies	8
9. Aledo-Somervell	8
10. Houston Black-Stephen	9
Land use considerations	9
Soil maps for detailed planning	10
Use and management of soils	42
Crops and pasture	42
Yields per acre	44
Land capability classification	45
Rangeland	45
Recreation	47
Wildlife habitat	47
Engineering	48
Building site development	49
Sanitary facilities	49
Construction materials	50
Water management	51
Town and country planning	52
Site selection	52
Foundations	53
Sewage disposal systems	53
Control of erosion and runoff	53
Potential for urbanization	54
Gardening and landscaping	55
Soil properties	55
Engineering properties and classifications	56
Physical and chemical properties	56
Soil and water features	57
Engineering test data	58
Classification of the soils	58
Soil series and morphology	59
Aledo series	59
Altoga series	59
Aquilla series	60
Aubrey series	60
Bastrop series	61
Birome series	61
Bolar series	62
Branyon series	62
Bunyan series	63
Burleson series	63
Callisburg series	64
Crockett series	64
Eddy series	65
Energy series	65
Ferris series	65
Frio series	66
Gasil series	66
Gowen series	67
Heiden series	67
Houston Black series	68
Justin series	68
Kaufman series	69
Konsil series	70
Lewisville series	70
Lindale series	71
Medlin series	71
Mingo series	72
Navo series	72
Ovan series	73
Ponder series	74
Rayex series	74
Sanger series	75
Seagoville series	76
Silawa series	76
Silstid series	77
Slidell series	77
Somervell series	78
Speck series	78
Stephen series	79
Trinity series	79
Vertel series	79
Wilson series	80
Formation of soils	80
Parent material	80
Climate	81
Plants and animals	81
Relief	81
Time	81
References	81
Glossary	82
Tables	87

Issued January 1980

Index to soil map units

	Page
1—Aledo association, undulating	10
2—Altoga silty clay, 3 to 5 percent slopes	10
3—Altoga silty clay, 5 to 8 percent slopes	11
4—Altoga silty clay, 5 to 12 percent slopes, eroded	11
5—Aquilla loamy fine sand, 2 to 5 percent slopes	11
6—Arents, gently undulating	12
7—Arents, hilly	12
8—Aubrey fine sandy loam, 2 to 5 percent slopes	12
9—Bastrop fine sandy loam, 1 to 3 percent slopes	13
10—Bastrop fine sandy loam, 3 to 5 percent slopes	13
11—Birome fine sandy loam, 1 to 3 percent slopes	13
12—Birome fine sandy loam, 3 to 5 percent slopes	14
13—Birome-Rayex-Aubrey complex, 2 to 15 percent slopes	14
14—Birome-Rayex-Urban land complex, 2 to 12 percent slopes	15
15—Birome-Urban land complex, 1 to 5 percent slopes	16
16—Bolar clay loam, 1 to 3 percent slopes	16
17—Bolar clay loam, 3 to 5 percent slopes	16
18—Branyon clay, 0 to 1 percent slopes	16
19—Branyon clay, 1 to 3 percent slopes	17
20—Bunyan fine sandy loam, frequently flooded	17
21—Burleson clay, 0 to 1 percent slopes	17
22—Burleson clay, 1 to 3 percent slopes	19
23—Callisburg fine sandy loam, 1 to 3 percent slopes	19
24—Callisburg fine sandy loam, 3 to 5 percent slopes	19
25—Callisburg soils, 2 to 5 percent slopes, severely eroded	20
26—Crockett fine sandy loam, 0 to 1 percent slopes	20
27—Crockett fine sandy loam, 1 to 3 percent slopes	20
28—Crockett-Urban land complex, 0 to 2 percent slopes	21
29—Eddy gravelly clay loam, 3 to 15 percent slopes	21
30—Energy fine sandy loam, frequently flooded	21
31—Ferris-Heiden clays, 3 to 5 percent slopes	22
32—Ferris-Heiden clays, 5 to 15 percent slopes	22
33—Frio silty clay, occasionally flooded	23
34—Frio silty clay, frequently flooded	24
35—Gasil fine sandy loam, 1 to 3 percent slopes	24
36—Gasil fine sandy loam, 3 to 8 percent slopes	24
37—Gasil-Urban land complex, 1 to 4 percent slopes	25
38—Gasil and Konsil soils, 1 to 5 percent slopes	25
39—Gowen clay loam, occasionally flooded	26
40—Gowen clay loam, frequently flooded	26
41—Heiden clay, 1 to 3 percent slopes	26
42—Heiden clay, 3 to 5 percent slopes	27
43—Houston Black clay, 0 to 1 percent slopes	27
44—Houston Black clay, 1 to 3 percent slopes	27
45—Justin fine sandy loam, 0 to 1 percent slopes	28
46—Justin fine sandy loam, 1 to 3 percent slopes	28
47—Justin fine sandy loam, 3 to 5 percent slopes	28
48—Justin-Urban land complex, 0 to 3 percent slopes	29
49—Kaufman clay, frequently flooded	29
50—Konsil fine sandy loam, 1 to 3 percent slopes	29
51—Konsil fine sandy loam, 3 to 8 percent slopes	30
52—Lewisville clay loam, 1 to 3 percent slopes	30
53—Lewisville clay loam, 3 to 5 percent slopes	30
54—Lindale clay loam, 1 to 3 percent slopes	31
55—Lindale-Urban land complex, 1 to 5 percent slopes	31
56—Medlin-Sanger clays, 5 to 15 percent slopes	31
57—Medlin-Sanger stony clays, 5 to 12 percent slopes	32
58—Mingo clay loam, 1 to 3 percent slopes	32
59—Navo clay loam, 0 to 1 percent slopes	32
60—Navo clay loam, 1 to 3 percent slopes	33
61—Navo clay loam, 3 to 5 percent slopes	34
62—Navo-Urban land complex, 0 to 3 percent slopes	34
63—Ovan clay, occasionally flooded	34
64—Ovan clay, frequently flooded	35
65—Ponder loam, 0 to 1 percent slopes	35
66—Ponder loam, 1 to 3 percent slopes	35
67—Sanger clay, 1 to 3 percent slopes	36
68—Sanger clay, 3 to 5 percent slopes	36
69—Sanger-Urban land complex, 1 to 4 percent slopes	36
70—Seagoville clay, occasionally flooded	36
71—Silawa loamy fine sand, 2 to 5 percent slopes	37
72—Silstid loamy fine sand, 1 to 5 percent slopes	37
73—Silstid-Urban land complex, 1 to 5 percent slopes	37
74—Slidell clay, 1 to 3 percent slopes	38
75—Somervell gravelly loam, 1 to 5 percent slopes	38
76—Speck clay loam, 1 to 3 percent slopes	38
77—Stephen silty clay, 1 to 5 percent slopes	39
78—Trinity clay, occasionally flooded	39
79—Trinity clay, frequently flooded	39
80—Vertel clay, 1 to 3 percent slopes	40
81—Vertel clay, 3 to 5 percent slopes	40
82—Vertel clay, 5 to 12 percent slopes	40
83—Wilson clay loam, 0 to 1 percent slopes	41
84—Wilson clay loam, 1 to 3 percent slopes	41
85—Wilson-Urban land complex, 0 to 2 percent slopes	41

Summary of tables

	Page
Temperature and precipitation (table 1)	88
Potentials and limitations of map units for specified uses (table 2)	89
Percent of area. Cultivated farm crops. Pasture. Rangeland. Urban uses. Recreation.	
Acreage and proportionate extent of the soils (table 3)	90
Acres. Percent.	
Yields per acre of crops and pasture (table 4)	92
Cotton lint. Grain sorghum. Wheat. Oats. Improved bermudagrass.	
Capability classes and subclasses (table 5)	96
Total acreage. Major management concerns.	
Range productivity and composition (table 6)	97
Range site name. Potential production. Common plant name. Composition.	
Recreational development (table 7)	107
Camp areas. Picnic areas. Playgrounds. Paths and trails.	
Wildlife habitat potentials (table 8)	112
Potential for habitat elements. Potential as habitat for—Openland wildlife, Wetland wildlife, Rangeland wildlife.	
Building site development (table 9)	117
Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets.	
Sanitary facilities (table 10)	122
Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.	
Construction materials (table 11)	127
Roadfill. Sand. Gravel. Topsoil.	
Water management (table 12)	132
Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.	
Potential for urbanization (table 13)	137
Elements of urbanization—Dwellings, Streets, Excavations, Uncoated steel pipe. Potential for urbanization. Major limitations.	

Summary of tables—Continued

	Page
Engineering properties and classifications (table 14) ..... *Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve—4, 10, 40, 200. Liquid limit. Plasticity index.*	141
Physical and chemical properties of soils (table 15) ..... *Depth. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Risk of corrosion. Erosion factors.*	149
Soil and water features (table 16) ..... *Hydrologic group. Flooding. High water table. Bedrock.*	154
Engineering test data (table 17) ..... *Depth. Shrinkage. Mechanical analysis. Liquid limit. Plasticity index. Classification.*	158
Classification of the soils (table 18) ..... *Family or higher taxonomic class.*	160

Foreword

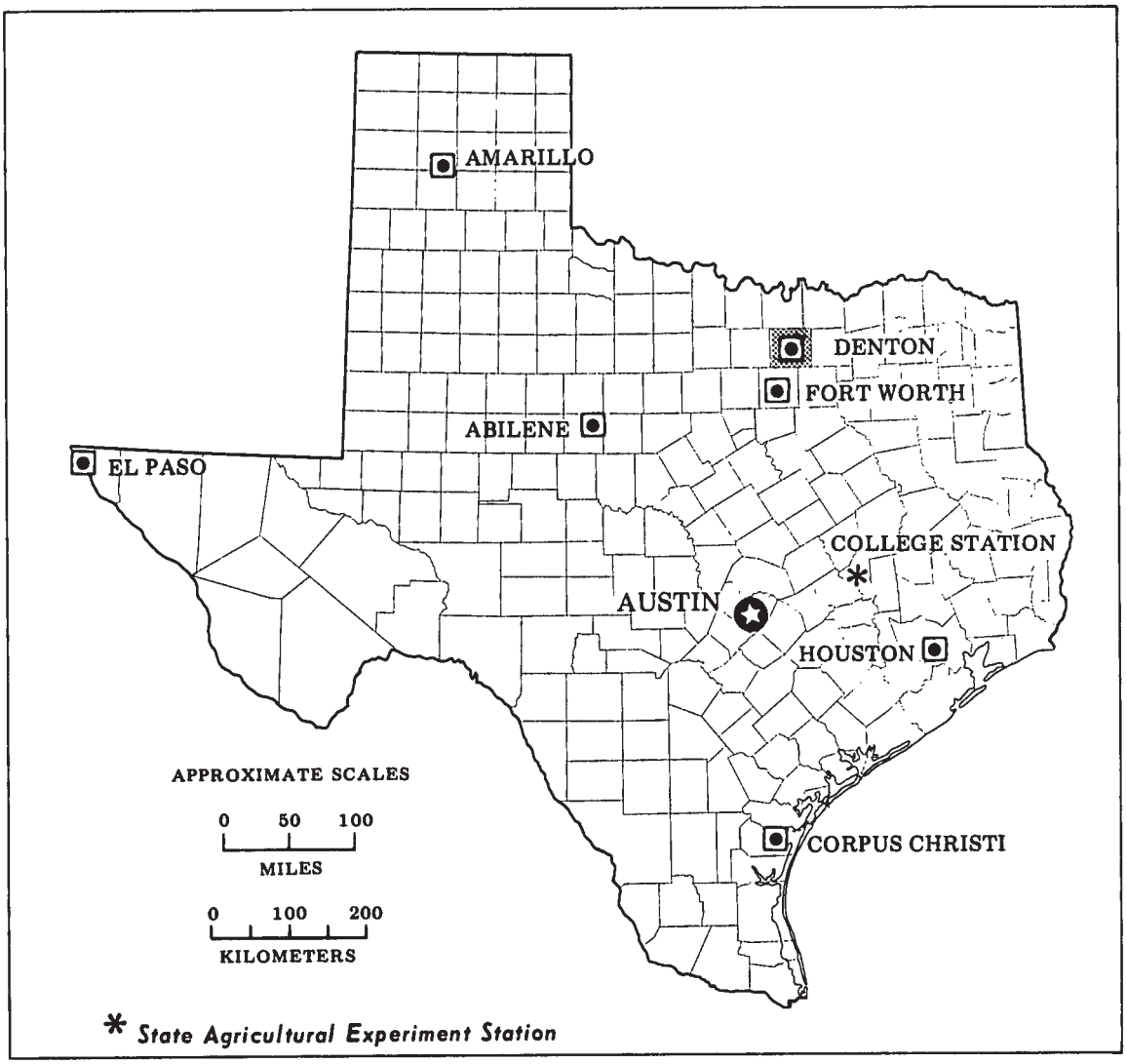
This soil survey contains information that can be used in land-planning programs in Denton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Denton County in Texas.

SOIL SURVEY OF DENTON COUNTY, TEXAS

By Alan Ford and Ed Pauls, Soil Conservation Service
Milton Allen, Authur Hanson, and J. O. McSpadden
assisted in the field mapping

United States Department of Agriculture
Soil Conservation Service
In cooperation with Texas Agricultural Experiment Station

DENTON COUNTY is in the north-central part of Texas. It is in the Blackland Prairie, Cross Timbers, and Grand Prairie land resource areas. Elevation ranges from 500 feet to 900 feet above sea level. Denton, the county seat, is about 40 miles northeast of Fort Worth on Interstate Highway 35. The city is a center of local trade and has industrial plants that make apparel, paper products, foods, mobile homes, and clay products. Denton, a center of education, has two state universities.

The county is almost square. It covers a total area of 958 square miles, or 613,120 acres—582,848 acres of land and 30,272 acres of water. The principal land uses are livestock grazing, crops, and urban development. Urbanization is rapidly increasing in the county.

General nature of the county

This section was prepared for those who want general information about Denton County. It discusses briefly the settlement and population, natural resources, agriculture, and climate of the county.

Settlement and population

Denton County was created in 1846 from a part of Fannin County. It was named for John B. Denton, a pioneer settler. The first settlers came into the county in 1842 from adjoining areas.

The 1920 population of the county was 35,355, some 78 percent of it rural. In 1970 the population was 75,633, and more than 60 percent of the people now reside in urban areas. Income from farm products accounted for less than 10 percent of the total county income in 1970.

Natural resources

Soil is the most important resource in Denton County. Livestock that graze the grassland and crops produced on farms are products derived from the soil.

Oil and gas are produced on a limited basis. Sand and gravel are important and are frequently found along the stream terraces.

Agriculture

The first settlers in Denton County were mainly cattlemen, but farming soon became important. Early farmers settled in the timbered areas of the county where materials for houses could be obtained and where water was available from streams. Cotton, corn, and small grain were important crops as were vegetables and fruits planted for home use. Although cotton continues to be an important crop today, a significant acreage has been replaced by grain sorghum, soybeans, and peanuts. Many acres of formerly cultivated land have been planted to permanent pasture.

According to the Conservation Needs Inventory of Texas for 1970, the county had a total of 183,460 acres in cropland in 1967. Some 291,831 acres were in pasture and range. The acreage of agricultural land is declining each year as urban areas expand.

Climate

Robert B. Orton, State climatologist, U.S. Department of Commerce, prepared this section.

The climate of Denton County is humid subtropical, and summers are hot. Tropical Maritime air masses from the Gulf of Mexico play a dominant role in the climate of the area during the spring, summer, and fall, and modified polar air masses contribute significantly to the winter climate. The prevailing winds at Denton are southerly throughout the year. Precipitation averages 31.99 inches annually, and is evenly distributed throughout the season, except for a relatively dry period in January and another in midsummer. May is the wettest month. The county experiences a wide range in annual temperature extremes, characteristic of a continental type of climate.

Seasonal changes in relative humidity are small. At noon Central Standard Time, the relative humidity averages 60 percent in both January and April, 50 percent in July, and 51 percent in October. Denton receives about 55 percent of the total possible sunshine in winter, 60 percent in spring, 76 percent in summer, and 68 percent in fall.

Winters are mild at Denton. As shown in table 1, minimum temperatures are 32 degrees F or below about six nights out of ten, but daily maximum temperatures average 59 degrees. Precipitation is associated with the passage of cold fronts. Snow may fall once or twice a month during the winter season but usually is of little consequence. The average total January snowfall is 1.0 inch. Sharp drops in temperature, and strong, gusty, northerly winds often accompany cold fronts in winter; however, cold spells are brief, and there are often periods of mild weather.

In spring there are many weather changes. Temperatures are pleasant, although warm and cool spells alternate in rapid succession. Early in spring it is often windy. Thundershower activity increases in both April and May when there is an average of seven thunderstorm days per month. Occasionally, thunderstorms are accompanied by destructive winds or hail late in spring or early in summer.

Summer weather is hot and humid with little variation from day to day. Refrigerated air-conditioning is recommended for maximum comfort indoors or while traveling. Thundershowers do not occur as often as in spring and are less frequent in July and August than in June.

Fall is a delightful season at Denton. Changes in weather occur with greater frequency than in summer, yet there are long uninterrupted periods of mild, sunny weather. Rainfall increases in September, then decreases gradually throughout October and November. Mean windspeeds are lower late in summer and early in fall than during any other period of the year. The climate is ideal for most outdoor activities.

The warm season (freeze-free period) at Denton averages 226 days, The average date of the last occurrence of 32 degrees or below in spring is March 27, and the first occurrence of 32 degrees or below in fall is November 8. In an average year, free water (lake) evaporation exceeds precipitation by 24 inches.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in

slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 2 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, rangeland, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Pasture refers to an area devoted to the production of forage, introduced or native, and harvested by grazing. Rangeland is land on which the native vegetation is dominantly grasses, grass-like plants, forbs, or shrubs suitable for grazing or browsing use. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic, as well as areas used for nature study and as wilderness.

Land area of the ten soil associations in Denton County makes up about 95.1 percent of the total acreage in the county. The rest is water.

Moderately deep and deep soils on upland savannahs

Most of the soils in this group are used for pasture and urban land. The soils have a loamy surface layer and have loamy and clayey lower layers. The native trees are hardwoods, and topography is rolling. These soils are attractive to builders and others who desire small acreages of scenic land.

1. Birome-Gasil-Callisburg

Well drained, gently sloping to moderately steep, loamy soils that have moderate to slow permeability

This map unit is made up of soils on uplands. Slopes are 1 to 15 percent. This unit covers about 24 percent of the county (fig. 1).

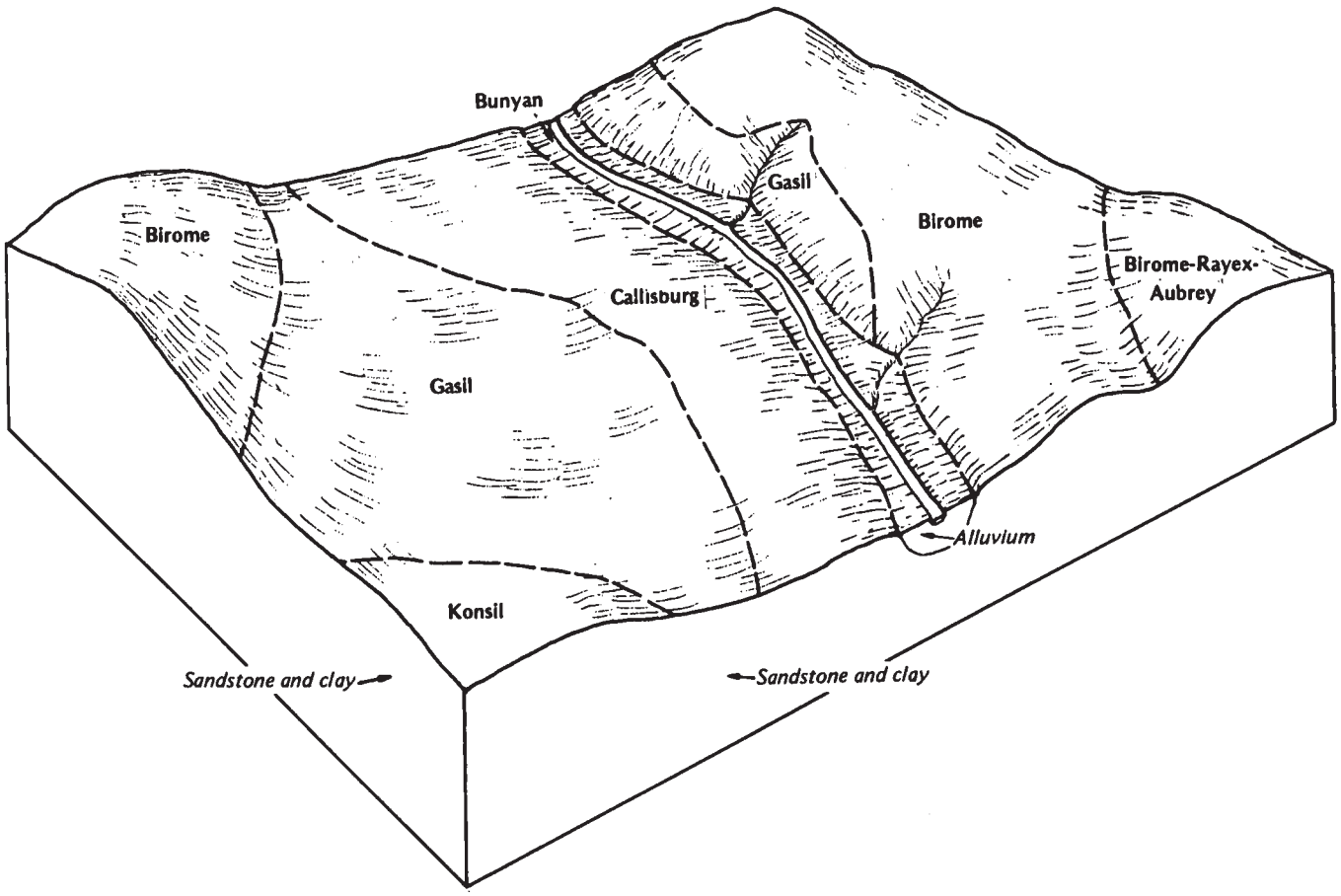


Figure 1.—Typical pattern of soils and underlying material in Birome-Gasil-Callisburg map unit.

Birome soils make up about 21 percent of the unit; Gasil soils, about 20 percent; and Callisburg soils, about 17 percent. Other soils make up the remaining 42 percent.

Birome soils are mainly on ridges. They have a neutral, brown, fine sandy loam surface layer about 6 inches thick. From 6 to 27 inches is medium acid, yellowish red clay. From 27 to 34 inches is medium acid, mottled yellowish red, strong brown, and red sandy clay. Below 34 inches is strong brown and yellowish red sandstone interbedded with very strongly acid brown, red, and gray shaly clay.

Gasil soils are on sides of ridges. They have a neutral, brown fine sandy loam surface layer about 7 inches thick. From 7 to 57 inches is brownish sandy clay loam. It is neutral to 16 inches and medium acid below that. From 57 to 80 inches is neutral, mottled brownish gray, strong brown, and red clay.

Callisburg soils are in gently sloping valley fill areas and on foot slopes of ridges. The soils have a medium acid, brown fine sandy loam surface layer about 5 inches thick. Between 5 and 13 inches is slightly acid, strong brown clay loam. From 13 to 32 inches is neutral, yellowish brown clay. From 32 to 56 inches is moderately alkaline, brownish yellow clay loam. From 56 to 80 inches is moderately alkaline, yellowish brown sandy clay loam.

Other soils in this unit are the Aubrey, Arents, Bunyan, Crockett, Justin, Konsil, Rayex, Silawa, and Silstid soils. Aubrey and Rayex soils are on gently sloping to moderately steep ridges and are mixed with Birome soils in some areas. Arents soils are in strip-mined areas on stream terraces. Bunyan soils are in frequently flooded bottom land areas. Crockett and Justin soils are in gently sloping valley fill and prairie areas, mainly on the outer edges of this map unit. Konsil, Silawa, and Silstid soils are on gently sloping upland ridges within areas of Gasil soils.

This map unit is used mainly for pasture and urban development. Peanuts are grown in some areas. Areas near cities are being covered by urban structures, and urban fringe areas are used for small ranches.

The soils in this unit have medium potential for range and pasture because fertility is low. Because there is a hazard of erosion and topography is sloping, potential for crops is medium. Potential for urban and recreational development is high. The native oak trees and scenic topography attract developers.

Moderately deep and deep soils on upland prairies

Most of the soils in this group are used for crops and rangeland although urban areas are expanding. The soils have a clay or clay loam surface layer and clayey lower layers.

2. Sanger-Somervell

Well drained, gently sloping to moderately steep, clayey and loamy soils that have moderate and very slow permeability

This map unit is made up of soils on upland ridges and valley fills. Slopes range from 1 to 15 percent. This unit covers about 23 percent of the county (fig. 2).

Sanger soils make up about 43 percent of the unit and Somervell soils about 19 percent. Less extensive areas of other soils make up the remaining 38 percent of the unit.

Sanger soils are on sides of ridges. Typically, these soils have a moderately alkaline, dark grayish brown clay surface layer about 38 inches thick. From 38 to 80 inches is moderately alkaline, light yellowish brown silty clay.

Somervell soils are on convex ridges. Typically, these soils have a moderately alkaline, dark grayish brown gravelly loam surface layer about 5 inches thick. Between 5 and 15 inches is moderately alkaline, dark grayish brown very gravelly loam. From 15 to 27 inches is moderately alkaline, light yellowish brown very gravelly clay loam. Below 27 inches is fractured, hard limestone rock with light gray, light yellowish brown, and yellow limy earth in the fractures.

Other soils in this unit are the Aledo, Bolar, Frio, Medlin, Mingo, Ponder, and Slidell soils. Aledo soils are on ridges in the highest part of the landscape. Bolar soils are on convex ridges and side slopes. Frio soils are on nearly level flood plains of small drains. Medlin soils are on sides of ridges. Mingo soils are in gently sloping areas. Ponder soils are in nearly level and gently sloping areas. Slidell soils are on the gently sloping valley fills along the drains in the lowest part of the landscape.

This unit is used mainly for crops and rangeland. Crops are mainly on the deeper soils in valley fills. Range is mainly on Somervell and other shallow and moderately deep soils on ridges. Some ridges within larger fields of the deeper soils are planted to small grain. Some ranches are divided into smaller holdings and planted to improved bermudagrass.

The soils in this map unit have medium potential for crops, pasture, and range.

The depth to rock and hazard of erosion are the main limitations. The soils in this unit have medium potential for urban and recreational development. The high shrink-swell, depth to rock, and corrosivity to uncoated steel are the main limitations for urban development. Clayey texture and very slow permeability are the limitations for recreational development.

3. Navo-Wilson

Well drained and somewhat poorly drained, nearly level to gently sloping loamy soils that have very slow permeability

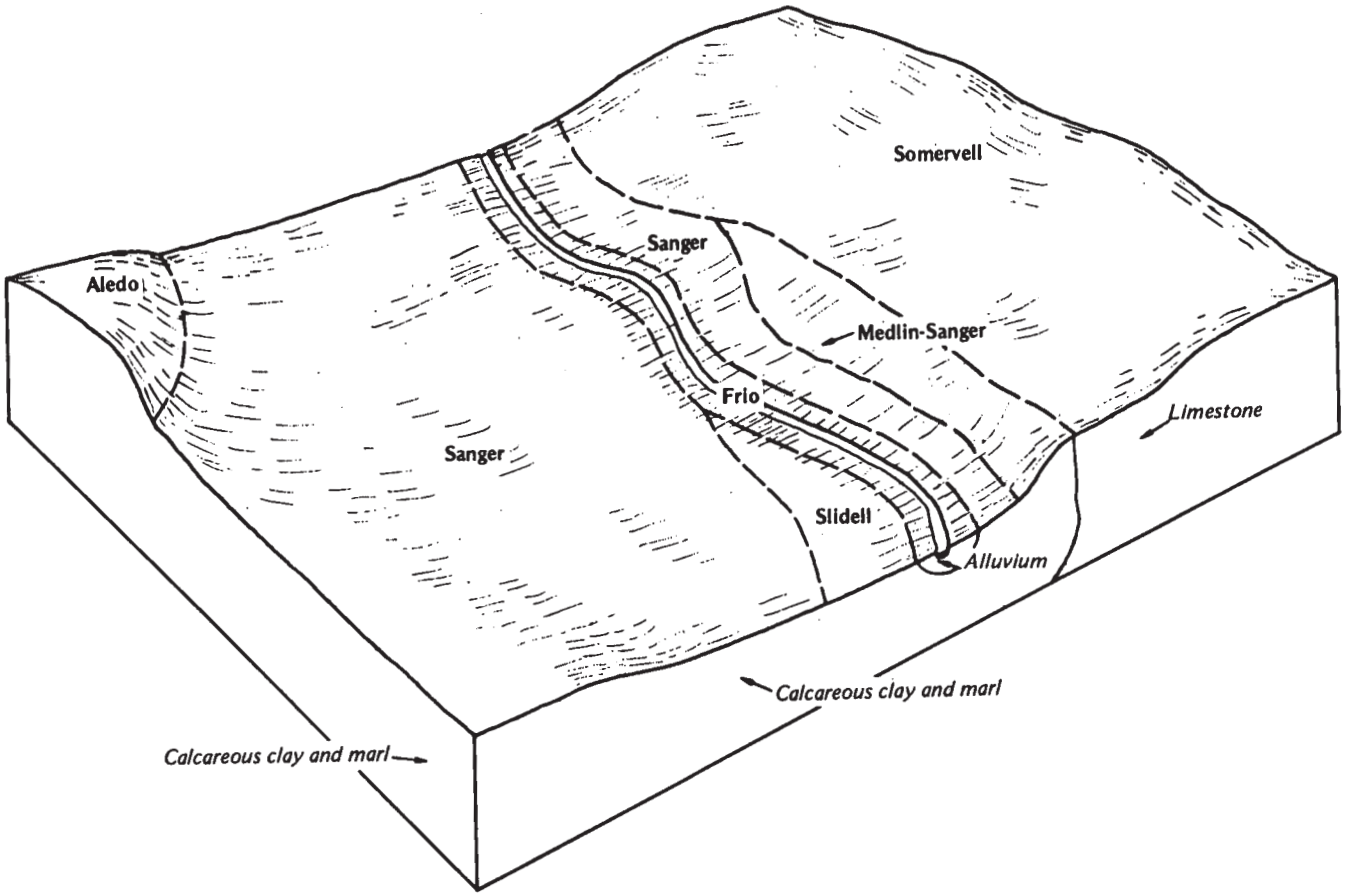


Figure 2.—Typical pattern of soils and underlying material in Sanger-Somervell map unit.

This map unit is made up of soils on ancient stream terraces in prairie areas. Slopes range from 0 to 5 percent. This unit covers about 12 percent of the county.

Navo soils make up about 41 percent of this unit; Wilson soils, about 31 percent; and less extensive areas of other soils make up the remaining 28 percent.

Navo soils are on slight ridges and side slopes of valleys. Typically, they have a slightly acid, brown clay loam surface layer about 5 inches thick. Between 5 and 22 inches is medium acid, reddish and brownish clay. Below 22 inches is moderately alkaline clay in shades of gray, brown, and yellow.

Wilson soils are in low areas along streams and valley fills. Typically, these soils have a slightly acid, gray clay loam surface layer about 5 inches thick. From 5 to 34 inches is slightly acid, dark gray clay. Below 34 inches is moderately alkaline clay in shades of brown and gray.

Other soils in this unit are the Bastrop, Bolar, Burleson, Callisburg, Crockett, Heiden, and Justin soils. Bastrop soils are on stream terraces. Burleson and Heiden soils are on uplands. Callisburg and Justin soils are on knolls on the outer edges of this unit. Crockett soils are in areas of Navo and Wilson soils. Ovan soils are on flood plains.

This map unit is used mainly for crops and pasture. Some areas of cropland are converted to improved pas-

ture. The potential for pasture, crops, and range is medium because of wetness.

The soils in this unit have medium potential for urban development. Shrink-swell properties, corrosivity to uncoated steel, low strength, and wetness are the restrictive features. The potential for recreational development is low because permeability is very slow and texture is clayey.

4. Branyon-Burleson-Heiden

Well drained and moderately well drained, nearly level to moderately steep, clayey soils that have very slow permeability

This map unit is made up of smooth ancient stream terraces in Blackland Prairie areas. Slopes range from 0 to 15 percent. This unit covers 7 percent of the county.

Branyon soils make up about 27 percent of this unit; Burleson soils about 25 percent; Heiden soils about 23 percent; and less extensive areas of other soils make up the remaining 25 percent.

Branyon soils are moderately alkaline, grayish clay about 80 inches thick.

Burleson soils have a neutral, gray clay surface layer about 17 inches thick. From 17 to 59 inches is moderately alkaline, gray clay. From 59 to 80 inches is moderately alkaline, light brownish gray clay.

Heiden soils typically have a surface layer of moderately alkaline, dark grayish brown clay about 17 inches thick. From 17 to 48 inches is moderately alkaline, grayish brown clay. From 48 to 66 inches is moderately alkaline, light olive brown clay. From 66 to 80 inches is moderately alkaline, mottled olive yellow, gray, and brownish yellow silty clay.

Other soils in this unit are the Houston Black, Ovan, Vertel, and Wilson soils. Houston Black soils are on the slightly higher landscapes within the unit.

Wilson soils are in positions similar to Burleson soils. Ovan soils are on flood plains. Vertel soils are on more sloping sides of valleys.

This map unit is used for crops and pasture. Areas in the southern part of the county are urbanized. The potential for cropland, pasture, and rangeland is high.

The soils in this unit have low potential for urban uses. The main restrictive features are low strength and shrink-swell properties.

The potential for recreational development is low because permeability is very slow and texture is clayey.

5. Altoga-Vertel-Ferris

Well drained, gently sloping to moderately steep, clayey soils that have moderate and very slow permeability

This map unit is made up of soils on side slopes and ridges. Slopes range from 1 to 15 percent. This unit covers about 7 percent of the county.

Altoga soils make up about 21 percent of the unit; Vertel soils about 21 percent; and Ferris soils about 8 percent. Less extensive areas of other soils make up the remaining 50 percent.

Altoga soils are on gently sloping to strongly sloping high stream terraces. Typically, these soils have a moderately alkaline, pale brown silty clay surface layer about 6 inches thick. The next layer, to a depth of 56 inches, is moderately alkaline, light yellowish brown silty clay. From 56 to 80 inches is moderately alkaline, brownish yellow silty clay.

Vertel soils are on gently sloping to strongly sloping sides of drains and convex ridges. Typically, these soils have a neutral, grayish brown clay surface layer about 6 inches thick. Between 6 and 33 inches is mildly alkaline, grayish brown clay. From 33 to 66 inches is medium acid, stratified dark gray, yellowish brown, yellow, and yellowish red shale.

Ferris soils are on gently sloping to moderately steep sides of drains and convex ridges. Typically, these moderately alkaline soils have a dark grayish brown clay surface layer about 6 inches thick. From 6 to 43 inches is light olive brown clay. From 43 to 60 inches is olive yellow shaly clay.

Other soils in this unit are Branyon, Heiden, Houston Black, Lewisville, Navo, and Trinity soils. Branyon, Heiden, and Houston Black soils are in nearly level to gently sloping, broad, smooth areas. Lewisville and Navo soils are on nearly level and gently sloping stream terraces. Trinity soils are on nearly level flood plains.

This map unit is used mainly for rangeland and pasture. Recreational areas are near the reservoir. The potential for crops and pasture is medium because the soils erode easily and are droughty. Potential for rangeland is high.

The soils in this unit have low potential for urban development. The high shrink-swell potential, clay textures, slope, corrosivity to uncoated steel, and very slow permeability are the main limitations. The potential for recreational development is low because of very slow permeability, slope, and clayey texture.

6. Slidell-Sanger

Well drained, gently sloping to moderately steep, clayey soils that have very slow permeability

This map unit covers valley fill areas and sides of ridges. Slopes range from 1 to 15 percent. This unit makes up about 6 percent of the county.

Slidell soils make up about 44 percent of the unit; Sanger soils about 26 percent; and less extensive areas of other soils make up the remaining 30 percent.

Slidell soils are in gently sloping valley fill areas and low landscapes along drains. Typically, these moderately alkaline soils have a dark gray clay surface layer about 6 inches thick. Clay extends to a depth of 80 inches or

more. It is very dark gray from 6 to 32 inches, grayish brown to 72 inches, and light brownish gray to 80 inches.

Sanger soils are on gently sloping to moderately steep sides of ridges. Typically, these moderately alkaline soils have a dark grayish brown clay surface layer about 38 inches thick. From 38 to 55 inches is light yellowish brown silty clay. From 55 to 80 inches is light yellowish brown silty clay.

Other soils in this unit are the Branyon, Burleson, Ponder, and Somervell soils. Branyon and Burleson soils are on nearly level to gently sloping valley fill areas intermixed with Slidell soils. Ponder soils are in nearly level to gently sloping areas. Somervell soils are on gently sloping ridges.

This map unit is used mainly for crops and pasture. Main crops are grain sorghum and small grain. Pastures are mainly improved bermudagrass, and some cropland is converted to pasture. Some farms are divided into small estates and part-time farms. The soils in this unit have high potential for crops, pasture, and rangeland.

The soils in this unit have low potential for urban land. Low strength, very slow permeability, corrosivity, and high shrink-swell properties are the main limitations. The soils have a low potential for recreational development because of the very slow permeability and clayey surface layers.

7. Ponder-Lindale

Well drained, nearly level to gently sloping, loamy soils that have slow to very slow permeability

This map unit is made up of upland soils. Slopes range from 0 to 5 percent. This unit covers about 6 percent of the county.

Ponder soils make up about 62 percent of the unit; Lindale soils about 21 percent; and less extensive areas of other soils make up the remaining 17 percent.

Ponder soils are in broad, smooth, nearly level to gently sloping areas. Typically, they have a neutral, brown loam surface layer about 7 inches thick. From 7 to 62 inches is brown clay that is medium acid in the upper part, slightly acid in the middle part, and neutral in the lower part. From 62 to 80 inches is moderately alkaline, very pale brown clay.

Lindale soils are on gently sloping convex ridges. Typically, these soils have a slightly acid, brown clay loam surface layer about 6 inches thick. Between 6 and 16 inches is mildly alkaline, reddish brown clay. From 16 to 32 inches is moderately alkaline, brown clay. From 32 to 43 inches is moderately alkaline, light brown very gravelly clay that is about 60 percent limestone gravel and cobbles. From 43 to 65 inches is moderately alkaline, reddish yellow gravelly clay that is about 20 percent limestone fragments.

Other soils in this unit are the Burleson, Justin, Mingo, Sanger, Slidell, Somervell, and Speck soils. Burleson and Justin soils are nearly level to gently sloping and are within areas of Ponder soils. Mingo soils are on gently sloping areas similar to Lindale soils. Sanger and Slidell soils are gently sloping and are on valley fills. Somervell and Speck soils are gently sloping and are on convex ridges underlain by limestone.

This map unit is used mainly for crops and rangeland. Crops are mainly on deeper soils and are mainly grain sorghum and small grain. Use of the soil for improved pasture is increasing. Areas near small cities are being used for urban development.

The soils in this unit have high potential for pasture and rangeland. Potential for crops is medium because there is a hazard of erosion in sloping areas. The potential for urban uses is medium. Low strength, corrosivity to uncoated steel, and shrink-swell properties are the main limitations.

Potential for recreation is medium because permeability is restricted and texture is clayey.

Deep soils on bottom lands

Most of the soils in this group are used for pasture and recreation. Areas not subject to frequent flooding are planted to crops. The soils are flooded during periods of high rainfall unless they are protected.

8. Frio-Ovan

Well drained and moderately well drained, nearly level, clayey soils that have moderately slow and very slow permeability

This map unit is made up of soils on flood plains of streams. Slopes are less than 1 percent. This unit covers about 11 percent of the county.

Frio soils make up about 42 percent of the unit; Ovan soils about 25 percent; and less extensive areas of other soils make up about 33 percent.

Frio soils typically have a moderately alkaline, very dark grayish brown silty clay surface layer about 9 inches thick. From 9 to 23 inches is moderately alkaline, dark grayish brown silty clay. From 23 to 64 inches is moderately alkaline, very dark grayish brown silty clay.

Ovan soils are moderately alkaline, grayish brown clay about 80 inches thick.

Other soils in this unit are the Aquilla, Arents, Bastrop, Bunyan, Gowen, Kaufman, Seagoville, and Trinity soils. The Arents soils are in the strip-mined areas mainly on low terraces. Aquilla and Bastrop soils are on gently sloping stream terraces. Bunyan and Gowen soils are on flood plains, mainly along small creeks. Kaufman, Trinity, and Seagoville soils are on nearly level flood plains.

This unit is used for crops, pasture, range, and wildlife. Crops are in areas that do not flood frequently, and are mainly grain sorghum. The potential for crops is high where the soil is protected from flooding, but it is low where frequently flooded. The potential for pasture,

range, and wildlife is high in both flooded and occasionally flooded areas.

The potential for urban development of this unit is very low. The potential for recreational use is low. Flooding, shrinking and swelling, and corrosivity of the soils are the main limitations.

Very shallow to deep soils on upland prairies

The soils in this group are used mainly as pasture and rangeland. Some small areas that are farmed along with surrounding deep soils are planted to small grain. The soils are high on the landscape and have scenic views.

9. Aledo-Somervell

Well drained, gently sloping to sloping, loamy soils that have moderate permeability

This map unit is made up of convex ridges and their benched side slopes. Slopes range from 1 to 8 percent. This unit covers about 3 percent of the county (fig. 3).

Aledo soils make up about 66 percent of the unit; Somervell soils about 20 percent; and less extensive areas of other soils make up the remaining 14 percent.

Aledo soils occupy high, convex ridges and narrow bands along the benches. Typically, this moderately alkaline soil has a brown clay loam surface layer about 4 inches thick. From 4 to 9 inches is brown very gravelly clay loam. Below 9 inches is fractured, hard limestone.

Somervell soils are on gently sloping, convex ridges and are mixed with other soils on the benched side slopes. Typically, these moderately alkaline soils have a dark grayish brown gravelly loam surface layer about 5 inches thick. Between 5 and 15 inches is dark grayish

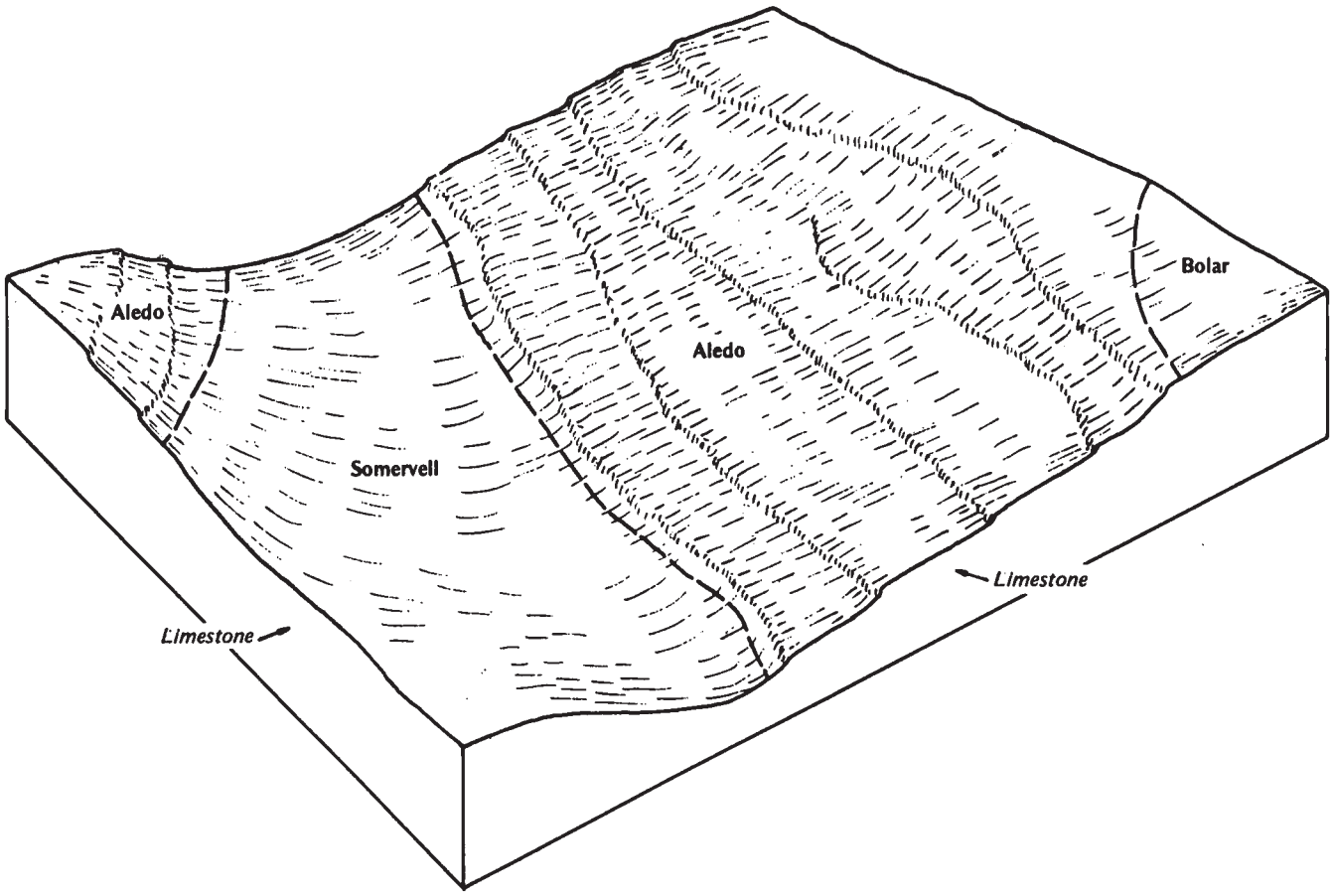


Figure 3.—Typical pattern of soils and underlying material in Aledo-Somervell map unit.

brown very gravelly loam. From 15 to 27 inches is light yellowish brown very gravelly clay loam. Below a depth of 27 inches is fractured, hard limestone rock with light gray, light yellowish brown, and yellow limy earth in the fractures.

Other soils in this unit are Bolar, Lewisville, Medlin, and Sanger soils. Bolar soils are on gently sloping, convex ridges and hills. Lewisville soils are on gently sloping foot slopes of high stream terraces. Medlin and Sanger soils are on sloping to moderately steep slopes above the drains. Some areas of Medlin and Sanger soils have large limestone rocks on and in the surface layer.

This unit is used as rangeland. Potential is low for range. The potential for crops and pasture is also low. The shallow and moderately deep rooting depths restrict plant growth. Because of the steep slopes and rock layers, this unit has medium potential for urban uses and recreational development.

10. Houston Black-Stephen

Moderately well drained and well drained, nearly level to gently sloping, clayey soils that have very slow and moderately slow permeability

This map unit is made up of convex ridges and sides of ridges. Slopes range from 0 to 5 percent. This unit covers about 1 percent of the county.

Houston Black soils make up about 46 percent of the unit, and Stephen soils make up about 28 percent. Less extensive areas of other soils make up the remaining 26 percent.

Houston Black soils are moderately alkaline. They typically have a very dark gray clay surface layer about 31 inches thick. From 31 to 56 inches is dark grayish brown clay. From 56 to 80 inches is mottled brownish yellow, pale brown, and light yellowish brown silty clay.

Stephen soils are on gently sloping, convex ridges. Typically, these moderately alkaline soils have a brown silty clay surface layer about 8 inches thick. From 8 to 14 inches is brown very gravelly silty clay that is about 80 percent chalk fragments. Below a depth of 14 inches is white platy chalk.

Other soils in this unit are the Eddy, Frio, and Heiden soils. Eddy soils are on convex ridges. Frio soils are on narrow flood plains. Heiden soils are in gently sloping areas in lower positions on the landscape.

This unit is used mainly for pasture. A few areas are planted to crops. These soils have medium potential for crops, pasture, and range because of the depth to rock of the Stephen soils.

The potential for urban development is medium. The depth to rock of the Stephen soils and high shrink-swell potential are the main limitations. The potential is low for recreational development because of very slow permeability and clayey texture.

Land use considerations

Most of the soils of Denton County have high or medium potential for growing cultivated farm crops. Sloping areas are subject to erosion, but most are suited to terraces. Some deep soils, such as those of the Altoga-Vertel-Ferris unit, have only medium potential for crops because they are moderately steep and erosion is difficult to control. The restricted permeability results in a greater amount of surface runoff, which increases the hazard of erosion where slopes are steep. The Aledo-Somervell unit has low potential for crops because of the shallow depth to rock and also the sloping terrain. Soils on the flood plains that are not frequently flooded have high potential for crops. The soils are deep and fertile. Wetness is a problem in some low areas. Where flooding is frequent, crops are damaged by the floodwater. These areas are best suited to permanent grass.

The use of soils for pasture is increasing in the county. The potential of most soils for pasture is medium or high. A significant acreage of formerly cultivated land is being planted to improved bermudagrass.

Rangeland potential of most soils in the county is medium or high. Some of the thinner soils, such as those of the Aledo-Somervell map unit, have low potential for range. Economic pressures have persuaded some land owners to plant high yielding introduced grasses in place of native grasses. Some ranchers use a combination of pasture and rangeland for livestock operations.

Each year a significant acreage in Denton County is developed for urban uses. About 150,000 acres, or nearly one-fourth of the land, is in areas where housing and industries are rapidly expanding. Much of this acreage has high or medium potential for crops. Most of the soils in Denton County have medium potential for urban development. Soils of the Frio-Ovan map unit, however, are on flood plains and have very low potential for urban development because there is a hazard of flooding. Soils of the Branyon-Burleson-Heiden, Altoga-Vertel-Ferris, and Slidell-Sanger map units have low potential for urban uses because they shrink and swell, have low strength, and are corrosive to uncoated steel. The Birome-Gasil-Callisburg unit has high potential for most urban uses.

Most soils in the county change greatly in volume upon wetting and drying. Good design and careful installation are necessary to prevent damage to foundations caused by the shrinking and swelling.

Because permeability is restricted and texture is clayey, most soils in Denton County have low or medium potential for recreational development. Areas near the lakes can be developed by using a good grass cover and by paving areas that are to get the most intensive use. The Altoga-Vertel-Ferris and Aledo-Somervell map units are particularly suitable for some forms of recreation because they offer scenic views.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. And they can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A number identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Sanger clay, 1 to 3 percent slopes, is one of several phases in the Sanger series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Birome-Rayex-Aubrey complex, 2 to 15 percent slopes, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Aledo association, undulating, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Gasil and Konsil soils, 1 to 5 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

1—Aledo association, undulating. This association is made up of shallow and very shallow soils on upland ridges and their side slopes. The side slopes have limestone strata that outcrop at each 5 to 20 feet of change in elevation. These outcrops of rock resist weathering and give the area a benched or terraced appearance. Slopes range from 1 to 8 percent. Soil areas typically are subrounded, and average about 40 acres.

Aledo and similar soils that have variable textures and are underlain by limestone rock at depths up to 20 inches make up about 65 percent of the association. Rock outcrops and soils that are 20 to 40 inches deep to rock make up about 35 percent of the association.

Typically, the Aledo soils have a moderately alkaline, brown clay loam surface layer about 4 inches thick. From 4 to 9 inches is moderately alkaline, brown very gravelly clay loam. This layer rests on hard, coarsely fractured limestone rock.

Aledo soils are well drained. Surface runoff is medium. Permeability is moderate. The available water capacity is very low. Some water seeps to the surface above the rock outcrops during wet seasons.

Included with this association in mapping are small areas of rock outcrop and Frio, Medlin, and Sanger soils. Frio soils are on narrow flood plains. Medlin and Sanger soils are on foot slopes.

This Aledo association is used as rangeland.

Potential is low for rangeland. The yield of native grass is low, but the forage is of a high quality. Management needs include proper stocking and controlled grazing.

The association has low potential for crops because of the slope, rock outcrops, and shallow soil. The potential is low for improved pasture.

The potential is medium for urban and recreational development because of the slope and rock outcrops.

This association is in capability subclass VIs; Shallow range site.

2—Altoga silty clay, 3 to 5 percent slopes. This deep, clayey, gently sloping soil is on high terraces of

major streams. Slopes are convex. The areas are oval to subrounded. They range from 10 to 250 acres.

Typically, the surface layer of this soil is moderately alkaline, pale brown silty clay about 6 inches thick. The next layer, from 6 to 56 inches, is moderately alkaline, light yellowish brown silty clay that is about 5 percent calcium carbonate concretions and soft bodies in the lower part. From 56 to 80 inches is moderately alkaline, brownish yellow silty clay.

This soil is well drained. Runoff is medium. Permeability is moderate. The available water capacity is high.

Included in mapping are small areas of Ferris, Heiden, and Lewisville soils. Heiden and Lewisville soils are in the less sloping areas. The included soils make up less than about 20 percent of any mapped area.

This Altoga soil is used mainly as pastureland, but some areas are planted to small grain. Potential for pasture is high. Potential for crops is medium. Crop residues left on the soil surface improve soil tilth and the level of organic matter. Terraces are needed to control runoff and reduce erosion.

Potential is high for rangeland. Range management should include proper stocking and controlled grazing.

The soil has medium potential for recreation uses because of the clayey surface. This limitation can be overcome by using loamy fill material and establishing a good grass cover.

This soil is in capability subclass IIIe; Clay Loam range site.

3—Altoga silty clay, 5 to 8 percent slopes. This deep, clayey, sloping soil is on old, high terraces of major streams. Slopes are convex. Soil areas are longer than they are wide. They range from 10 to 250 acres.

Typically, the surface layer is moderately alkaline, brown silty clay about 6 inches thick. From 6 to 30 inches is moderately alkaline, light yellowish brown silty clay. From 30 to 60 inches is moderately alkaline, light yellowish brown silty clay that is about 10 percent calcium carbonate concretions, films, and threads. From 60 to 80 inches is moderately alkaline, very pale brown silty clay.

This soil is well drained. Surface runoff is medium. Permeability is moderate. The available water capacity is high. Hazard of water erosion is severe.

Included in mapping are small areas of Ferris, Heiden, and Lewisville soils. The Heiden and Lewisville soils are less sloping. Included soils make up less than about 15 percent of any mapped area.

This Altoga soil is used mainly as rangeland. Potential is high for range production. Management needs include proper stocking and controlled grazing.

The potential is low for crops because of the slope and hazard of erosion. The potential is medium for pasture because of the slope and hazard of erosion. Some areas formerly in crops have been planted to bermudagrass, which is suited to this soil.

The potential is medium for recreation uses because of the clayey surface layer. This limitation can be overcome by using loamy fill material and establishing a good grass cover.

This soil is in capability subclass IVe; Clay Loam range site.

4—Altoga silty clay, 5 to 12 percent slopes, eroded. This deep, clayey, sloping to strongly sloping, eroded soil is on old high terraces of major streams. Soil areas are long and narrow and range from 5 to 80 acres.

Eroded areas make up about 40 percent of the mapped areas. The eroded areas consist of rills and gullies 12 to 36 inches deep that have nearly vertical sides. They are fan shaped at the upper part of the slope and become narrow and deeper at the lower part.

Typically, Altoga silty clay has a moderately alkaline, pale brown silty clay surface layer about 5 inches thick. From 5 to 50 inches is moderately alkaline, very pale brown silty clay loam with about 5 percent soft bodies of calcium carbonate in the lower part. From 50 to 70 inches is moderately alkaline, yellow clay loam. Below 70 inches is sand and gravel.

This soil is well drained. Surface runoff is medium. Permeability is moderate. The available water capacity is high. The hazard of water erosion is severe, and erosion is active in most areas.

Included in mapping are small areas of less sloping Altoga and Lewisville soils and a soil similar to Altoga soil that has a loamy subsoil. The included soils make up less than 25 percent of any mapped area.

This Altoga soil is used as rangeland and for recreation. It is not suited to crops because of slope and erosion.

The potential for pasture is low because the eroded areas are low in fertility and difficult to cross with equipment and because response to fertilizer is limited in eroded areas.

Potential is high for rangeland. The eroded areas are mainly bare ground or grow low quality forage. Range seeding is needed in most areas.

The potential is medium for recreational development because the surface layer is clayey and most areas are eroded. These limitations can be overcome by smoothing the eroded areas, using loamy fill material, and establishing a good grass cover.

This soil is in capability subclass VIe; Clay Loam range site.

5—Aquilla loamy fine sand, 2 to 5 percent slopes. This deep, gently sloping, sandy soil is on old terraces of the major streams. Soil areas have a smooth surface, are rounded, and range from 14 to 135 acres.

Typically, the surface layer is mildly alkaline, brown loamy fine sand about 13 inches thick. From 13 to 56 inches is mildly alkaline, reddish yellow loamy fine sand. From 56 to 80 inches is mildly alkaline, light brown

loamy fine sand with mottles of strong brown and yellowish red sandy clay loam.

This soil is somewhat excessively drained. Runoff is slow. Permeability is moderately rapid. The available water capacity is low. A water table is 48 to 60 inches below the surface for short periods during seasons of high rainfall. Soil blowing is a slight hazard when the soil is bare.

Included in mapping are small areas of Silstid soils. Also included are small areas of soils that are similar to the Aquilla soil but do not have mottles of sandy clay loam. This soil is mainly along fence rows near sandy fields. The included soils make up less than about 20 percent of any mapped area.

This Aquilla soil is used for pasture, for which potential is high. Common and improved bermudagrasses are the main grasses.

Potential is low for crops. The low available water capacity and thick sandy surface layer are the main limitations. Crop residues left on the soil surface help maintain the content of organic matter.

This soil has medium potential for range production. Management needs include proper stocking and controlled grazing.

This soil has medium potential for recreational development. The sandy surface blows when bare, and soil blowing is the major limitation.

This soil is in capability subclass IIIs; Deep Sand range site.

6—Arents, gently undulating. These deep, loamy soils are within mined out sand and gravel pits in which the remaining soil material has been smoothed and revegetated to grass. They are on the lower parts of the landscape, mainly stream terraces. Slopes range from 1 to 5 percent. The soil areas are somewhat rounded and range from 5 to 65 acres.

These soils are mostly loamy and contain varying amounts of sand and gravel. Because they are lower than the surrounding landscape, they are subject to occasional flooding from runoff.

Included in mapping are small pits that usually contain water.

These soils are used for pasture and wildlife. The potential for pasture production is medium. The main grasses are common and improved bermudagrass. Runoff water collects in low areas and provides habitat for ducks.

Potential for range production is medium, but the range needs to be seeded. Management should include proper stocking and deferred grazing.

These soils are not suitable for crops. The uneven topography, restricted drainage, and flood hazard are the main limitations.

The potential for recreation development of these soils is low. The flood hazard and restricted drainage are the main limitations.

These soils are in capability subclass VIw; Clay Loam range site.

7—Arents, hilly. These deep, loamy soils are in gravel and sand pits, in which the remaining soil material, after the sand or gravel was removed, was left in piles. Slopes range from 10 to 30 percent. Runoff water collects in low areas, which are occasionally flooded. A significant input of energy would be required to reclaim these soils for agricultural or industrial uses. The areas are mainly rounded and range from 10 to about 175 acres.

The soil material is extremely variable. It is stratified in texture and color but is mainly loamy material. Colors are in shades of red, brown, or yellow. The soils contain varying amounts of sand and gravel.

Included in some mapped areas are small pits. These are usually filled with water.

These soils are idle or are used for wildlife. They are not suited to crops. Water that collects in low areas provides habitat for wildlife.

The potential for pasture, range, and wildlife habitat is medium. The potential for recreational development is low. Leveling and smoothing are necessary before these soils can be planted to grass. After they are smoothed, the main limitations are the hazard of flooding and the somewhat poor drainage.

These soils are in capability subclass VIIe; Clay Loam range site.

8—Aubrey fine sandy loam, 2 to 5 percent slopes. This moderately deep, gently sloping, loamy soil is on sides and tops of ridges. Soil areas are somewhat oval and average about 70 acres.

Typically, the surface layer is medium acid, brown fine sandy loam about 6 inches thick. From 6 to 20 inches is very strongly acid, red clay. From 20 to 27 inches is very strongly acid, red and gray clay. From 27 to 66 inches is very strongly acid, light gray and strong brown clayey shale.

This soil is well drained. Permeability is slow. Available water capacity is low. Runoff from this soil is medium, and the hazard of water erosion is high. The moderately deep root zone and acid subsoil limit the kinds of plants that are suited to this soil. Liming is beneficial to neutralize the soil reaction and to supply calcium to the plants.

Included in mapping are small areas of Birome and Callisburg soils. Birome soils, underlain by sandstone, are on low ridges. Callisburg soils are on the lower part of the landscape. Included soils make up less than about 10 percent of any mapped area.

This Aubrey soil is used for pasture. The main grass is common bermudagrass. Undisturbed areas have stands of post oak and scattered areas of Florida paspalum, Virginia wildrye, and panicums. Potential for pasture is medium.

Potential for crops is low. Liming is needed to supply calcium and neutralize the acid soil. Terraces are essential to control erosion.

This soil has low potential for rangeland. Management needs include proper stocking, controlled grazing, and brush management.

Potential for recreational use is medium. Slow permeability is the main limitation.

This soil is in capability subclass IIIe; Tight Sandy Loam range site.

9—Bastrop fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on high terraces above the flood plains of major streams. Soil areas are subrounded and range from 5 to 65 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 5 inches thick. The next layer, which extends to a depth of about 16 inches, is neutral, reddish brown sandy clay loam. From 16 to 56 inches is neutral, yellowish red sandy clay loam. From a depth of 56 to 80 inches is neutral, reddish yellow sandy clay loam with a few dark brown mottles.

This soil is well drained. Surface runoff is medium. Permeability is moderate. Available water capacity is high. Response to fertilizer is good, and the soil is easily worked. Sediments below this soil are a source of sand and gravel in some areas. Accessible areas are strip mined.

Included in mapping are small areas of Callisburg, Konsil, and Lewisville soils. Callisburg and Konsil soils are slightly higher on the landscape than the Bastrop soil. Included soils make up less than 20 percent of any area.

This Bastrop soil is used mainly for pasture. The main grasses are common and Coastal bermudagrass. Potential for pasture is high. The soil has high potential for row crops and small grain. Crop residues left on the soil surface help slow runoff and maintain the organic matter level of the soil.

Potential for rangeland is medium. Management needs include proper stocking, controlled grazing, and brush management.

The soil has high potential for recreational development and pecan and fruit orchards.

This soil is in capability subclass IIe; Sandy Loam range site.

10—Bastrop fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on high terraces above the flood plains of major streams. Soil areas are elongated and range from 5 to about 30 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 8 inches thick. From 8 to 27 inches is neutral, reddish brown sandy clay loam. The next layer, to a depth of 73 inches, is neutral, yellowish red sandy clay loam.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is high. Response to fertilizer is good, and the soil is easily worked. Sediments below this soil are a source of sand and gravel in some places.

Included in mapping are small areas of Callisburg and Konsil soils and some less sloping areas of Bastrop soils. Included soils make up less than about 20 percent of any area.

This Bastrop soil is used for pasture and wildlife habitat and has high potential for these uses. The main pasture grasses are common and Coastal bermudagrass.

The soil has medium potential for crops. Erosion is the major hazard in cultivated areas. Crop residues left on the soil surface reduce runoff. Terraces, waterways, and diversions are needed to control erosion.

The soil has medium potential for rangeland. Management needs include proper stocking, controlled grazing, and brush management.

The potential for recreational development is high. The soil is well suited to pecan and fruit orchards.

This soil is in capability subclass IIIe; Sandy Loam range site.

11—Birome fine sandy loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on convex ridges and the lower side slopes. Soil areas are subrounded and range from 4 to 50 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 6 inches thick. From 6 to 32 inches is slightly acid, reddish yellow clay that has strong brown mottles in the lower part. From 32 to 60 inches is yellowish red, weakly cemented sandstone interbedded with very strongly acid, red and gray shaly clay. There are common ironstone and sandstone pebbles throughout the soil (fig. 4).

This soil is well drained. Surface runoff is rapid. Permeability is slow. Available water capacity is low. The hazard of erosion is moderate where slopes are unprotected. The limited root zone reduces productivity.

Included in mapped areas are small areas of Callisburg, Konsil, and Rayex soils. Callisburg and Konsil soils are on the lower slopes. Rayex soils are on slight ridges and on the higher landscape. Included soils make up less than 20 percent of any mapped area.

This Birome soil is used primarily as pasture, for which it has medium potential. Its potential for crops is medium because of the restricted root zone. Residues from crops left on the soil surface help conserve moisture, slow runoff, and improve productivity.

This soil has medium potential for rangeland. Management needs include proper stocking, controlled grazing, and brush management.

The soil has medium potential for recreational development.

This soil is in capability subclass IIe; Sandy Loam range site.

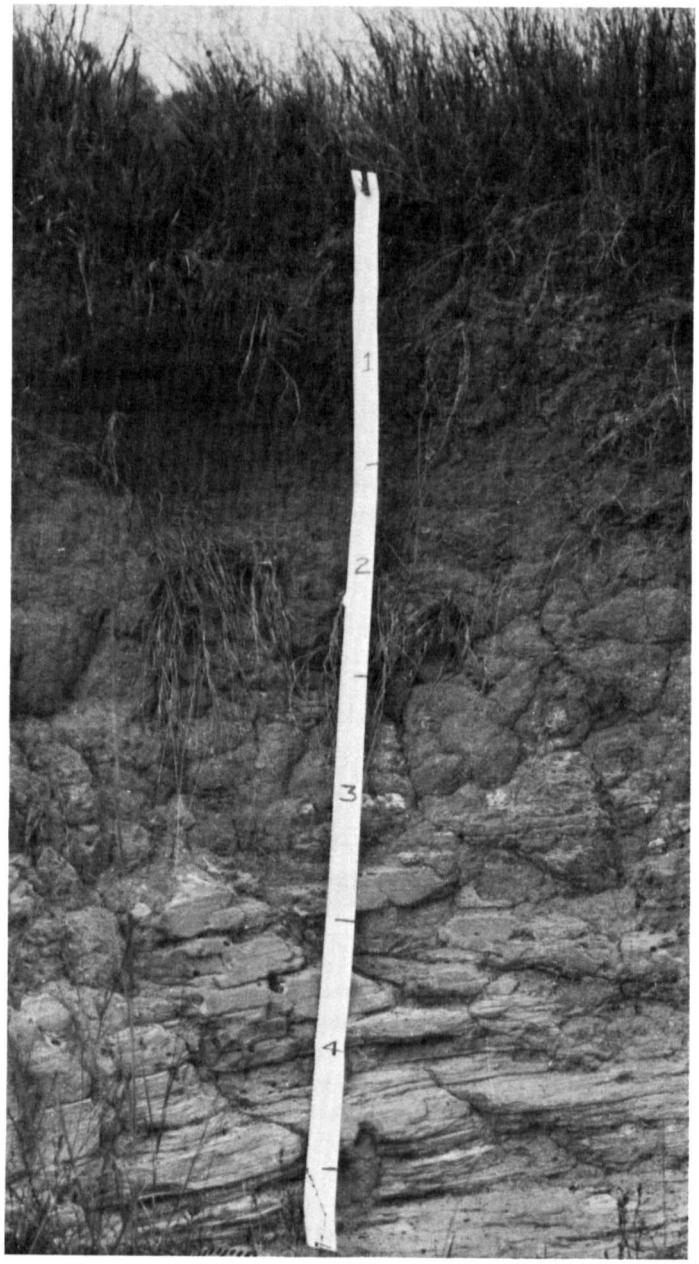


Figure 4.—Profile of Birome fine sandy loam, 1 to 3 percent slopes, showing sandstone below 32 inches.

12—Birome fine sandy loam, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on convex ridges and side slopes. Soil areas are subrounded and range from 5 to 50 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 6 inches thick. From 6 to 27 inches is medium acid, yellowish red clay. This layer has strong brown mottles in the lower part. From 27 to 34 inches is medium acid, mottled yellowish red, strong brown, and red sandy clay. From 34 to 60 inches is strong brown and yellowish red, weakly cemented sandstone that is interbedded with very strongly acid, red and gray, shaly clay. There are common ironstone and sandstone pebbles throughout the soil.

This soil is well drained. Runoff is rapid. Permeability is slow. Available water capacity is low. The hazard of erosion is moderate where slopes are not protected. The limited root zone reduces productivity.

Included in mapping are small areas of Callisburg, Konsil, and Rayex soils. Callisburg and Konsil soils are on lower slopes. Rayex soils are on low ridges. Also included are some eroded spots of Birome soils that have shallow gullies. Included soils make up less than 20 percent of any mapped area.

This Birome soil is used primarily as pasture and rangeland. Its potential for row crops is low. The sloping topography and moderately deep root zone limit crop yields. The soil has medium potential for pasture.

This soil has medium potential for rangeland. Management needs include proper stocking, controlled grazing, and brush management.

Potential for most recreational use is high. Slow permeability is a limitation for some playgrounds and camp areas.

This soil is in capability subclass IIIe; Sandy Loam range site.

13—Birome-Rayex-Aubrey complex, 2 to 15 percent slopes. The gently sloping to moderately steep soils of this complex are on convex ridges. Soil areas have a smooth surface and are subrounded. They range from 8 to 110 acres.

About 33 percent of this complex is Birome soils, about 32 percent Rayex soils, about 29 percent Aubrey soils, and about 6 percent other soils. Areas of these soils are so intricately mixed that separation is not practical at the scale mapped. Sandstone outcrops form convex benches wherever there is a change in elevation of 10 to 25 feet. The Rayex soils are on these benches, the Aubrey soils are mainly above the Rayex soils, and the Birome soils are below the benches (fig. 5).

Birome soils have a slightly acid, brown fine sandy loam surface layer about 8 inches thick. The surface layer is about 10 percent sandstone fragments, 3 inches to 4 feet across, that have been deposited from the sandstone outcrops on the higher slopes. From 8 to 16 inches is medium acid, red clay. From 16 to 31 inches is medium acid, red clay with yellowish red mottles and common sandstone gravel. From a depth of 31 to 66 inches is fractured, brownish sandstone interbedded with very strongly acid, red and gray shaly clay.

These soils are moderately deep and well drained. Permeability is slow. Runoff is rapid. The available water capacity is low. The hazard of water erosion is severe.

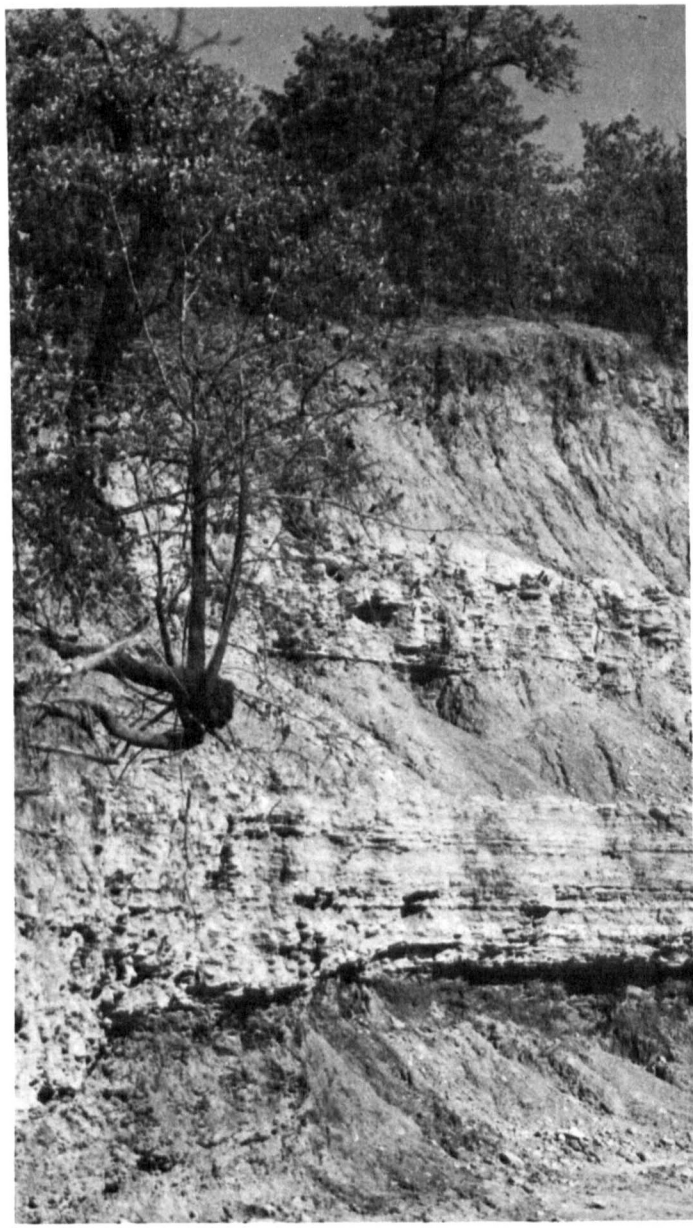


Figure 5.—Exposed sandstone and clay layers in Birome-Rayex-Aubrey complex, 2 to 15 percent slopes.

Rayex soils have a neutral, brown fine sandy loam surface layer about 7 inches thick. It is about 15 percent sandstone fragments 3 inches to 4 feet across. From 7 to 15 inches is strongly acid, red clay. Below 15 inches is fractured, yellowish red sandstone that is interbedded with thin layers of very strongly acid, red and gray shaly clay.

These soils are shallow and well drained and have rapid runoff. They have moderately slow permeability. The available water capacity is very low. The hazard of water erosion is severe.

Aubrey soils have a slightly acid, brown fine sandy loam surface layer about 8 inches thick. From 8 to 26 inches is strongly acid, red clay. From a depth of 26 to 66 inches is very strongly acid, red and gray shaly clay.

These soils are well drained. Permeability is slow. Runoff is rapid resulting in a severe erosion hazard. Available water capacity is low. Water seeps to the surface during periods of excess rainfall.

The soils in this complex are used for pasture and urban development. They are not suitable for crops. Large stones, shallow rooting depth, and sloping topography are major limitations. Potential for pasture is low. The soils are suited to bermudagrass, but the steep slopes, large stones, and limited available moisture are difficult to overcome.

This soil complex has low potential for rangeland. Management needs include proper stocking, controlled grazing, and brush management.

Potential for recreation and wildlife is medium.

This complex is in capability subclass VIe; Birome part in sandy loam range site, Rayex part in Sandstone Hills range site, Aubrey part in Tight Sandy Loam range site.

14—Birome-Rayex-Urban land complex, 2 to 12 percent slopes. The gently sloping to strongly sloping soils of this complex are on convex ridges. Soil areas have a smooth surface and range from 15 to 200 acres.

Birome soils make up 20 to 30 percent of the complex, Rayex soils make up 20 to 30 percent, Urban land makes up 20 to 80 percent, and included soils make up 30 percent or less. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Birome soils have a neutral, brown fine sandy loam surface layer about 8 inches thick. From 8 to 31 inches is medium acid, red clay. Below 31 inches is fractured sandstone interbedded with very strongly acid, red and yellowish red shaly clay.

Birome soils are well drained. Runoff is rapid, and permeability is slow. The available water capacity is low. The hazard of water erosion is severe.

The Rayex soils of this complex have a neutral, brown fine sandy loam surface layer about 7 inches thick. The surface layer has common sandstone fragments. Between 7 and 15 inches is strongly acid, red clay. Below 15 inches is yellowish red sandstone interbedded with very strongly acid, red and gray shaly clay.

Rayex soils are well drained. Runoff is rapid, and permeability is moderately slow. The available water capacity is very low. The shallow rooting depth, very low available water capacity, and soil reaction limit the choice of plants that are suited to this soil.

Urban land consists of areas of works and structures and other disturbed areas in which the soil has been so altered that classification is not practical. The areas are

covered by individual dwellings and businesses and adjoining streets, driveways, and parking lots. Some areas have been disturbed by cutting, grading, and filling.

Other soils included in mapping this complex are areas of Aubrey, Callisburg, and Konsil soils.

Potential for recreational use is medium because of slope and depth to rock.

This soil is not placed in a capability subclass or range site.

15—Birome-Urban land complex, 1 to 5 percent slopes. This gently sloping complex is on convex ridges. Soil areas have a smooth surface and range from 10 to 300 acres.

Birome soils make up 40 to 65 percent of the complex, Urban land 20 to 30 percent, and other soils less than 35 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Birome part of this complex has a neutral, brown fine sandy loam surface layer about 6 inches thick. From 6 to 27 inches is medium acid, reddish yellow clay. Below 27 inches is yellowish red, weakly cemented sandstone interbedded with very strongly acid, red and gray shaly clay.

Birome soils are well drained. Runoff is rapid, and permeability is slow. The available water capacity is low. The hazard of erosion is moderate. The soil reaction and moderately deep root zone are major considerations when selecting plants for this soil.

Urban land is covered by individual dwellings and adjoining streets, driveways, sidewalks, and patios. Some areas have been disturbed or obscured so that classification of the original soil is not practical. More sloping areas have been cut, filled, and partially leveled. This has exposed the sandstone lower layer in some places.

Included with this complex in mapping are mainly areas of Aubrey, Callisburg, and Konsil soils.

Potential for recreation use is high. Slow permeability limits some playground and camp areas uses.

This complex is not placed in a capability subclass or range site.

16—Bolar clay loam, 1 to 3 percent slopes. This moderately deep, gently sloping, calcareous soil is on convex ridges and upland side slopes. Soil areas are rounded and range from 5 to 37 acres.

Typically, the surface layer is moderately alkaline, brown clay loam about 13 inches thick. From 13 to 18 inches is moderately alkaline, brown clay loam. From 18 to 34 inches is moderately alkaline, brownish yellow clay loam with yellowish brown mottles and accumulations of soft and hard calcium carbonate. Below 34 inches is fractured limestone rock interbedded with marly clay.

This soil is well drained. Runoff is medium, and permeability is moderate. The available water capacity is low. Erosion is a hazard on this soil where it is left unprotected. Chlorosis, a yellowing of plants, is a problem with some plants grown on this soil.

Included in mapping are small areas of Aledo, Sanger, and Somervell soils. Aledo and Somervell soils are on slight ridges. Sanger soils are on foot slopes and narrow valley fills. Included soils make up less than 20 percent of any mapped area.

This Bolar soil is used mainly as rangeland. Potential is medium for this use. Management needs include proper stocking and controlled grazing.

The potential for crops is medium. Crop residues left on the soil surface reduce runoff and help maintain productivity. The potential for pasture is medium. Improved bermudagrass is well suited to this soil.

The soil has high potential for recreational use.

This soil is in capability subclass IIe; Clay Loam range site.

17—Bolar clay loam, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on convex ridges and upland side slopes. Soil areas are subrounded and range from 5 to 50 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam about 13 inches thick. From 13 to 20 inches is moderately alkaline, grayish brown clay loam. From 20 to 31 inches is moderately alkaline, light olive brown clay loam with a few soft masses of calcium carbonate. Between 31 and 36 inches is moderately alkaline, light brownish gray silty clay loam with common soft masses and concretions of calcium carbonate. Below 36 inches is hard, fractured limestone rock interbedded with light brownish gray and pale yellow marly clay.

This soil is well drained. Runoff is rapid. Permeability is moderate. Available water capacity is low. The hazard of erosion is moderate on this soil. Some plants are subject to chlorosis.

Included in mapping are small areas of Aledo, Sanger, and Somervell soils. Aledo and Somervell soils are on benches and ridges. Sanger soils are on the lower slopes and in valley fill areas. Included soils make up less than 20 percent of any mapped area.

This Bolar soil is used mainly as rangeland. Potential for rangeland is medium.

The potential for row crops is low and production of small grain is moderate. Terraces and waterways are needed to protect the soil from erosion. The potential for pasture is medium. Improved bermudagrass is well suited to this soil.

This soil has high potential for recreational use.

This soil is in capability subclass IIIe; Clay Loam range site.

18—Branyon clay, 0 to 1 percent slopes. This deep, nearly level soil is on broad, smooth valley fills and ancient terraces. Soil areas have a smooth surface and are rounded. They range from 45 to 600 acres. Untilled

areas have wavy relief that is made up of a series of microknolls and microdepressions. The microknolls are 8 to 16 feet apart and 6 to 15 inches higher than the bottoms of the microdepressions.

Typically, the surface layer is moderately alkaline, dark gray clay about 56 inches thick. From 56 to 80 inches is moderately alkaline, gray clay with yellowish brown mottles.

This soil is moderately well drained. Runoff is slow, and permeability is very slow. The available water capacity is high. When the soil is dry it has cracks that extend to depths of 30 to 60 inches. This soil is difficult to till during extremes in its moisture content.

Included in mapping are small areas of Burleson, Houston Black, and Trinity soils. Houston Black soils are on the slightly higher parts of the landscape. Trinity soils are on flood plains along narrow drains. Included soils make up less than about 15 percent of any mapped area.

This Branyon soil is used mainly for crops. The potential for growing row crops and small grain is high. Crop residues left on the surface help improve tilth and maintain the organic matter content of the soil. The potential for pasture is high.

This soil has high potential for rangeland. The management needs include proper stocking and controlled grazing. Few scattered elm, hackberry, and mesquite trees are in most native areas.

The potential for recreational development is low. The clayey texture of the soil is the main limitation; however, this can be overcome by keeping a good grass cover and using loamy fill material.

This soil is in capability subclass IIw; Blackland range site.

19—Branyon clay, 1 to 3 percent slopes. This deep, gently sloping soil is in valley fill areas and on side slopes around the outer edges of ancient terraces. Soil areas are long and narrow and range from 15 to about 115 acres. Untilled areas are characterized by a relief of microdepressions and microknolls. Microknolls are 8 to 16 feet apart and 6 to 15 inches higher than microdepressions.

Typically, this soil is a moderately alkaline, gray clay about 80 inches thick.

This soil is moderately well drained. Runoff is medium. Permeability is very slow. Available water capacity is high. When the soil is dry, it has cracks that extend from depths of 30 to 60 inches. This soil is difficult to work during extremes in its moisture content.

Included in mapping are small areas of Burleson, Houston Black, and Lewisville soils. Houston Black soils are on the convex, slightly higher parts of the landscape. The Lewisville soils are on foot slopes. Included soils make up less than 20 percent of any mapped area.

This Branyon soil is used mainly for pasture and crops. Its potential for row crops and small grain is high. Terraces and diversions are needed to protect cropland from erosion. Crop residues left on the soil surface help improve tilth. Pasture potential is high.

The potential for rangeland is high. Management needs include proper stocking and controlled grazing.

The potential for recreational development is low. The clayey texture is the main limitation. This soil can be used for recreation by maintaining a good grass cover or using loamy fill material.

This soil is in capability subclass IIe; Blackland range site.

20—Bunyan fine sandy loam, frequently flooded. This deep, nearly level soil is mainly on narrow flood plains of streams that drain from sandy and loamy soils. Some areas are on slight benches or overwashes above the more clayey soils on the larger flood plains. Soil areas have a smooth surface, are elongated, and range from 70 to about 200 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 21 inches thick. From 21 to 66 inches is moderately alkaline, brown sandy clay loam with a few, thin, dark brown clay loam strata.

This soil is well drained. Runoff is slow, and permeability is moderate. Available water capacity is high. This soil is subject to flooding one or more times each 2 years. Brief floods occur during periods of high rainfall in spring and fall. The soil is productive, and crops respond well to fertilizer.

Included in mapping are small areas of Gowen soils. Gowen soils are slightly lower on the landscape than the Bunyan soil and in depressions on the outer edges of the flood plain. A soil similar to the Bunyan soil that has a thin sandy surface layer is included in some areas. Included soils make up less than about 15 percent of any mapped area.

This Bunyan soil is used for pasture and wildlife. The potential for pasture is high, and improved bermudagrass does well on this soil. Pecans are well suited to this soil. The potential for crops is low because of flooding, but the potential is high in areas protected from flooding. This soil provides good habitat for openland wildlife.

The potential for rangeland is high. Management needs include proper stocking, controlled grazing, and brush management.

The potential for recreational development is low because of the flood hazard.

This soil is in capability subclass Vw; Loamy Bottomland range site.

21—Burleson clay, 0 to 1 percent slopes. This deep, nearly level soil is on ancient upland terraces. The surface is smooth and areas are mainly rounded. They range from 7 to 200 acres. In undisturbed areas the surface is wavy and is characterized by microknolls and microdepressions. The microknolls are 3 to 10 inches higher than the microdepressions and their centers are 5

to 12 feet apart. This microrelief is smoothed out by a few years of tillage (fig. 6).

Typically, the surface layer in the center of a microdepression is neutral, gray clay about 17 inches thick. From 17 to 46 inches is moderately alkaline, gray clay. From 46 to 59 inches is moderately alkaline, gray clay with brown mottles and dark gray vertical streaks. From 59 to 80 inches is moderately alkaline, light brownish gray clay with yellowish brown mottles.

This soil is moderately well drained. Runoff is slow, and permeability is very slow. Available water capacity is high. When dry, the soil has deep cracks that extend from the surface to a depth of 30 to 60 or more inches. Water enters the soil rapidly where it is cracked, but very slowly when it is wet and the cracks are sealed. Water is slow to drain from the soil surface. The soil is difficult to work during extremes in moisture content. Continuous tillage to the same depth causes a plowpan to develop that impedes movement of roots, air, and water.

Included in mapping are small areas of Branyon and Wilson soils. The Branyon soils mainly are on the slightly lower parts of the landscape. The loamy Wilson soils are on slight ridges. These included soils make up less than 15 percent of any mapped area.

This Burleson soil is used as cropland, pasture, and rangeland.

The potential for crops is high. The main cultivated crops are grain sorghum and cotton. Crop residues maintained on the soil surface improve tilth and maintain the level of organic matter. Cover crops of grasses and legumes are beneficial in preventing the formation of plowpans and improving soil tilth.

The potential for pasture is high. This soil is well suited to improved bermudagrass. Some cultivated areas are planted to this grass.

Potential for rangeland is high. Management needs include proper stocking and controlled grazing.

Potential for recreational areas is low. The main limitations are the clayey texture and very slow permeability of the soil. Surface drainage, loamy fill material, and good grass cover are needed when using this soil for playgrounds, picnic areas, or camp sites.

This soil is in capability subclass IIw; Blackland range site.

Figure 6.—Microrelief on Burleson clay, 0 to 1 percent slopes.

22—Burleson clay, 1 to 3 percent slopes. This deep, gently sloping soil is on valley fills and edges of upland terraces. Soil areas are mainly longer than they are wide and range from 8 to 100 acres. In undisturbed areas the surface is characterized by a series of microknolls and microdepressions. The microknolls are 3 to 10 inches higher than the microdepressions and they are 8 to 12 feet apart. The microrelief can be destroyed by several years of tillage.

The surface layer in the center of the microdepression is typically mildly alkaline, dark gray clay about 37 inches thick. From 37 to 53 inches is moderately alkaline, gray clay with brown mottles. From 53 to 75 inches is moderately alkaline, grayish brown clay with grayish brown mottles.

This soil is moderately well drained. Runoff is medium, and permeability is very slow. Available water capacity is high. When dry, this soil has deep cracks that extend to a depth of 30 to 60 inches. Water enters the soil rapidly when it is dry and cracked and very slowly when it is wet and the cracks are sealed. This soil is difficult to work during extremes in the moisture content. Continuous tillage at the same depth causes a plowpan to form and impede the movement of roots, air, and water. There is a hazard of erosion where the soil is left bare.

Included in mapping are small areas of Branyon and Wilson soils. Wilson soils are on the slightly higher parts of the landscape. The included soils make up less than about 20 percent of any mapped area.

This Burleson soil is used mainly for improved pasture. Some fields are planted to small grain and grain sorghum. A few areas are in rangeland.

Potential for crops is high. Crop residues left on the surface will help prevent water erosion and improve soil tilth. Terraces and contour farming are needed to reduce erosion. Cover crops are needed to improve soil tilth.

The potential for pasture is high. This soil is suited to improved bermudagrass.

This soil has high potential for rangeland. Management needs include proper stocking and controlled grazing.

The potential for recreation is low because the soil has a clayey texture and very slow permeability.

This soil is in capability subclass IIe; Blackland range site.

23—Callisburg fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes and valley fills of uplands. Soil areas are subrounded, have a smooth surface, and range from 7 to about 90 acres.

Typically, the surface layer is medium acid, brown fine sandy loam about 5 inches thick. From 5 to 13 inches is slightly acid, strong brown sandy clay. From 13 to 32 inches is neutral, yellowish brown clay with pale brown mottles. From 32 to 56 inches is moderately alkaline, brownish yellow sandy clay with a few strong brown and gray mottles. From 56 to 80 inches is moderately alkaline, yellowish brown sandy clay loam with strong brown and light gray mottles.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow. Available water capacity is high.

Included in mapping are small areas of Birome, Crockett, Gasil, and Konsil soils. Birome, Gasil, and Konsil soils are on low ridges higher on the landscape than the Callisburg soil. Crockett soils are in low areas. Included soils make up less than 20 percent of any mapped area.

This Callisburg soil is used mainly for pasture and rangeland. Some fields are planted to peanuts. Pastures are mainly improved bermudagrass. The potential for pasture is medium.

This soil has a medium potential for crops. Truck crops are also suited to this soil. Crop residues returned to the soil surface help control erosion and maintain organic matter. Terraces and contour farming are needed to help control erosion.

The potential for rangeland is medium. Management needs include proper stocking, controlled grazing, and brush management.

This soil has high potential for most recreational uses. It has medium potential for playgrounds because of moderately slow permeability.

This soil is in capability subclass IIe; Sandy Loam range site.

24—Callisburg fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on low sides of ridges. Soil areas are longer than they are wide and range from 5 to about 150 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 5 inches thick. From 5 to 25 inches is slightly acid, yellowish red sandy clay with yellowish brown mottles. From 25 to 41 inches is medium acid, brownish yellow clay loam with reddish yellow mottles. From 41 to 68 inches is slightly acid, brownish yellow sandy clay with reddish yellow and gray mottles.

This soil is well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is high. The hazard of erosion is severe.

Included in mapping are small areas of Birome, Gasil, and Konsil soils. These soils are on low ridges, slightly higher on the landscape than Callisburg soils. Included soils make up about 20 percent of any mapped area.

This Callisburg soil is used as pasture and rangeland. The potential for pasture is medium, and improved bermudagrass is well suited to this soil.

Potential for crops is medium. Terraces and contour farming are needed to maintain the level of organic matter.

Potential for rangeland is medium. Management needs include proper stocking, deferred grazing, and brush management.

Potential for most recreational development is high. The moderately slow permeability is a limitation for playground uses.

This soil is in capability subclass IIIe; Sandy Loam range site.

25—Callisburg soils, 2 to 5 percent slopes, severely eroded. These are severely eroded, deep, loamy, gently sloping soils on sides of ridges. Soil areas are mainly square, retain the shape of the formerly cultivated fields, and are 5 to about 35 acres.

These soils are cut by a series of gullies that are 50 to 120 feet apart. The gullies are 1 to 4 feet deep and 6 to 25 feet wide. The intergully areas are slightly or moderately eroded soils that have lost a part of their surface layer.

Typically, the soil between the gullies has a slightly acid, brown fine sandy loam surface layer about 3 inches thick. From 3 to 16 inches is slightly acid, pale brown clay loam with strong brown mottles. From 16 to 37 inches is neutral, very pale brown clay with strong brown and reddish yellow mottles. From 37 to 60 inches is mildly alkaline, pale brown clay with brown and grayish brown mottles.

In gullied areas the surface layer of fine sandy loam has been removed and the clayey lower layers have been exposed.

These soils are well drained. Surface runoff is medium. Permeability is moderately slow. Available water capacity is high. The hazard of erosion is severe. The gullies can be smoothed, shaped, and planted to permanent vegetation. Shaping and smoothing are needed to control the erosion.

Included in mapping are small eroded areas of Birome, Gasil, and Konsil soils. These soils are mainly on the upper slopes of the eroded areas. Included soils make up less than about 35 percent of any mapped area.

These Callisburg soils are used as pasture. They are unsuitable for use as cropland. Grass is mainly sparse stands of common bermudagrass, threeawns, and silver bluestem.

Potential for pasture is medium. Some smoothed and shaped areas of these soils produce moderate yields of common and improved bermudagrass. Maintaining a vigorous stand of grass is vital to the control of erosion.

Potential for rangeland is medium. Management needs include controlled grazing and brush management.

Potential for recreational use of these soils is low. They need to be shaped and smoothed before they can be used for recreation.

These soils are in capability subclass VIe; Sandy Loam range site.

26—Crockett fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on smooth uplands and in valley fill areas. Soil areas are longer than they are wide and range from 8 to 120 acres.

Typically, the surface layer is about 6 inches of medium acid, yellowish brown fine sandy loam. From 6 to 31 inches is slightly acid, brown clay with yellowish brown and yellowish red mottles. From 31 to 47 inches is mildly alkaline, grayish brown clay with yellowish brown mottles. From 47 to 66 inches is moderately alkaline, grayish brown and yellowish brown sandy clay.

This soil is moderately well drained. Runoff is slow. Permeability is very slow. Available water capacity is high. The soil is difficult to work during extremes in moisture content. Roots have difficulty penetrating the clayey subsoil.

Included in mapping are small areas of Navo and Wilson soils. The Navo and Wilson soils are in the slightly lower positions on the landscape. These included soils make up less than 30 percent of any mapped area.

This Crockett soil is used for pasture, crops, and urban development. Potential is high for pasture. The main pasture grasses are common and improved bermudagrass, which produce high amounts of forage.

This soil has medium potential for crops. Crops are mainly peanuts and small grain. Crop residues left on the soil surface help maintain the organic matter level and improve tilth. Cover crops are beneficial on this soil. Low lying and concave areas benefit from drainage. Mesquite trees invade abandoned fields and poorly managed areas.

The potential for rangeland is medium. Good yields can be obtained with proper stocking, brush management, and controlled grazing.

The potential for recreational development of this soil is medium. The restricted permeability is the main limitation. When using this soil as recreational sites, drainage and careful plant selection are needed.

This soil is in capability subclass IIIs; Claypan Prairie range site.

27—Crockett fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on smooth uplands and in valley fill areas. Soil areas are longer than they are wide and range from 10 to about 80 acres.

Typically, the surface layer is about 6 inches of neutral, pale brown fine sandy loam. From 6 to 15 inches is medium acid, mottled reddish brown, light brownish gray, and reddish yellow clay. From 15 to 55 inches is mildly alkaline clay mottled in shades of brown, gray, and red. From 55 to 66 inches is moderately alkaline, mottled pale brown, light gray, and brownish yellow clay.

This soil is moderately well drained. Runoff is medium. Permeability is very slow. Available water capacity is high. Erosion is a moderate hazard. Roots have difficulty penetrating the clayey subsoil.

Included in mapping are small areas of Callisburg, Justin, and Navo soils. The Callisburg soils are on the higher convex ridges. Justin and Navo soils are along the outer edges of areas of Crockett soil. Included soils

make up less than about 20 percent of any mapped area.

This Crockett soil is used mainly for pastures of common and improved bermudagrass. The potential for pasture is high.

The potential for crops is medium. Some fields are planted to peanuts. Crop residues left on the soil surface help maintain the level of organic matter and reduce soil erosion. Cover crops are beneficial on this soil. Terracing and contour farming are needed to reduce erosion.

The potential for rangeland is medium. Management needs include proper stocking rate and controlled grazing.

The potential for recreational development of this soil is medium. The very slow permeability is a limitation for use as camp areas and playgrounds. Drainage and paving can be installed when this soil is used for playgrounds, camp areas, or picnic areas.

This soil is in capability subclass IIIe; Claypan Prairie range site.

28—Crockett-Urban land complex, 0 to 2 percent slopes. This complex is made up of nearly level and gently sloping soils in valley fills and on the low parts of the landscape. Soil areas have a smooth surface and average about 50 acres.

Crockett soils make up 50 to 75 percent of the unit, Urban land 20 to 40 percent, and included soils 20 percent or less. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Crockett part of this complex has a slightly acid, yellowish brown fine sandy loam surface layer about 6 inches thick. From 6 to 41 inches is slightly acid, dark brown, brown, and grayish brown clay. From 41 to 66 inches is mildly alkaline, grayish brown clay with yellowish brown mottles.

Crockett soils are moderately well drained. Runoff is rapid, and permeability is very slow. Available water capacity is high. The soil receives runoff from the higher, adjoining slopes. The dense clay subsoil is a factor to consider when selecting plants for this soil. Water should be applied at a slow rate because of the very slow permeability.

Urban land is mainly the site of individual dwellings and adjoining streets, sidewalks, driveways, and patios with some neighborhood businesses, schools, and churches. A few areas have been covered with loamy material.

Included in mapping this complex are small areas of Callisburg, Justin, and Navo soils.

Potential for recreational use is medium because of very slow permeability.

This complex is not placed in a capability subclass or range site.

29—Eddy gravelly clay loam, 3 to 15 percent slopes. This very shallow to shallow, gently sloping to moderately steep soil is on convex ridges and side slopes. Soil areas are longer than they are wide and range from 5 to about 90 acres.

Typically, the surface layer is moderately alkaline, grayish brown gravelly clay loam about 4 inches thick. From 4 to 8 inches is moderately alkaline, grayish brown gravelly clay loam that is about 50 percent chalky limestone fragments. Below 8 inches is white, platy chalky limestone.

This soil is well drained. Runoff is rapid. Permeability is moderately slow. The available water capacity is very low. The hazard of erosion is high. The shallow rooting depth restricts plant growth on this soil.

Included in mapping are areas of Stephen soils and chalk outcrops. The Stephen soils mainly are on the lower parts of the landscape. The rock outcrops are in the strongly sloping and moderately steep areas. Included soils make up less than 20 percent of any mapped area.

This Eddy soil is used mainly as rangeland.

The potential for pasture is low. Some fields have been planted to improved bermudagrass.

Potential for rangeland is low. Management needs include deferred grazing and proper stocking. Brush management may be needed in some areas.

Potential for crops is low. The depth to chalk and the hazard of erosion are the main limitations. If crops are grown, they should be limited to close-spaced winter crops such as small grain.

Potential for recreational development is low because of small stones and depth to rock. The trees and rolling topography are attractive for paths, trails, and green belt areas.

This soil is in capability subclass IVs; Chalky Ridge range site.

30—Energy fine sandy loam, frequently flooded. This deep, nearly level soil is on flood plains of major streams. Soil areas are longer than they are wide and are mainly adjacent to the stream channel. They range from 20 to 400 acres. Flooding occurs one or more times each 1 to 5 years unless the soil is protected.

Typically, the surface layer is moderately alkaline, light gray fine sandy loam about 4 inches thick. From 4 to 42 inches is alternating bands of moderately alkaline, very pale brown, brown, and light brownish gray fine sandy loam. From 42 to 60 inches is moderately alkaline, dark grayish brown clay loam.

This soil is well drained. Surface runoff is slow, and permeability is moderate. The available water capacity is medium. Flooding is a major hazard on this soil. The soil is easily worked, and response to management is good.

Included in mapping are small areas of Frio soils. The Frio soils are on the lower parts of the landscape along

the outer edges of mapped areas. Included soils make up less than about 20 percent of any mapped area.

This Energy soil is used mainly for pasture and wildlife. The potential for pasture forage is high. The potential for wildlife habitat is medium.

This soil has low potential for crops because of the hazard of flooding. If protection from flooding is provided, the soil has high potential for crops. Crop residues left on the soil surface will help maintain the level of organic matter and conserve moisture. Low lying areas may benefit from shallow surface drains.

The potential for rangeland is high. Management needs include proper stocking, controlled grazing, and brush management.

This soil has low potential for recreational use. The flood hazard is the major limitation. Protection by levees and diversions is difficult to provide.

This soil is in capability subclass Vw; Loamy Bottomland range site.

31—Ferris-Heiden clays, 3 to 5 percent slopes. These gently sloping soils are on convex ridges and sides of drains. Soil areas have a smooth surface, are rounded, and range from 4 to about 200 acres. The relief in undisturbed areas is characterized by microknolls and microdepressions. The microknolls are 12 to 15 inches higher than the microdepressions, and their centers are 14 to 17 feet apart.

About 40 percent of this complex is Ferris soils, about 37 percent Heiden soils, and about 23 percent is other soils. Ferris soils mainly are on the microknolls, and Heiden soils are in the microdepressions. These soils are so intricately mixed that separation is not practical at the scale mapped.

Ferris soils are moderately alkaline. Typically, they have a dark grayish brown clay surface layer about 6 inches thick. From 6 to 43 inches is light olive brown clay. From 43 to 60 inches is olive yellow shaly clay with strong brown mottles.

Heiden soils are moderately alkaline. Typically, the surface layer is dark grayish brown clay about 17 inches thick. From 17 to 49 inches is light olive brown clay. From 49 to 60 inches is olive and yellow shaly clay.

The soils in this complex are well drained. Surface runoff is rapid, resulting in a severe erosion hazard. Permeability is very slow. Available water capacity is high. The soils are difficult to work during extremes in the moisture content.

Included in mapping of this complex are areas of Altoga, Burleson, and Houston Black soils. These are mainly below the soils of this complex on the landscape.

This complex is used mainly as rangeland and pasture. Some small fields are planted to row crops and small grain.

The potential for rangeland is high. Most native range areas have good stands of high quality plants. Management needs include deferred grazing and proper stocking.

This complex has medium potential for pasture. Common and improved varieties of bermudagrass are suitable.

The potential for crops is medium. Terraces and waterways are necessary to control runoff and reduce erosion. Crop residues left on the soil surface aid in erosion control. Tillage should be done on the contour.

The potential for recreational development is low. The clayey texture and very slow permeability are the main limitations. Maintaining a good grass cover and limiting traffic reduce the hazard of erosion.

This complex is in capability subclass IIIe; Ferris part in Eroded Blackland range site and Heiden part in Blackland range site.

32—Ferris-Heiden clays, 5 to 15 percent slopes. These sloping to moderately steep soils are on convex ridges and sides of drains. Soil areas are subrounded and range from 9 to about 100 acres. The relief in undisturbed areas consists of microknolls and microdepressions. The microknolls are 6 to 12 inches higher than the microdepressions, they are aligned up and down the slope, and their centers are 15 to 20 feet apart.

About 50 percent of this complex is Ferris soils, about 40 percent Heiden soils, and about 10 percent is similar soils. Areas of these soils are so intricately mixed that separation is not practical at the scale mapped.

Typically, the Ferris soils have a moderately alkaline, dark grayish brown clay surface layer about 6 inches thick. From 6 to 43 inches is moderately alkaline, light olive brown clay. From 43 to 60 inches is moderately alkaline, olive yellow shaly clay with strong brown mottles.

Typically, the Heiden soils have a moderately alkaline, dark grayish brown clay surface layer about 19 inches thick. From 19 to 37 inches is moderately alkaline, light olive brown clay. From 37 to 60 inches is moderately alkaline, brownish yellow clay.

The soils in this complex are well drained. Runoff is rapid. Permeability is very slow. Available water capacity is high. The hazard of erosion is severe where slopes are not protected. The soil is difficult to work during extremes in the moisture content.

Included in mapping are areas of Altoga and Vertel soils. Altoga soils are on the slightly lower parts of the landscape. Vertel soils are on convex areas mainly along the lower slopes. Some eroded areas and shallow gullies are included. These included soils make up about 10 percent of mapped areas.

This complex is used mainly as rangeland. The potential for rangeland is medium. Management needs include proper stocking and deferred grazing. Brush management may be needed. Mesquite trees are in most areas.

The potential for pasture is low. The soils are suitable to common and improved bermudagrass. Seedbeds are difficult to prepare because the soils have clayey texture and steep slopes.

These soils are not suitable for crops.

The potential for recreational development is low. The clayey texture, slope, and very slow permeability are the main limitations. The steep slopes are suitable for scenic areas. Erosion control is necessary in areas of heavy use.

This complex is in capability subclass VIe; Ferris part in Eroded Blackland range site and Heiden part in Blackland range site.

33—Frio silty clay, occasionally flooded. This deep, nearly level soil is on flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from 5 to about 100 acres.

Typically, the surface layer of this soil is moderately alkaline, brown silty clay about 8 inches thick. The next layer, from 8 to 24 inches, is moderately alkaline, dark grayish brown silty clay. From 24 to 42 inches is moderately alkaline, very dark grayish brown silty clay. From 42 to 60 inches is moderately alkaline, grayish brown silty clay.

This soil is well drained. Runoff is slow, and permeability is moderately slow. Available water capacity is high. Some areas of this soil are subject to flooding for less than 2 days duration about once each 5 to 10 years. The soil is difficult to work when the moisture content is high. The response to fertilizer is good.

Included in mapping are small areas of Ovan and Trinity soils. These are slightly lower on the landscape than the Frio soil. Some areas of Frio soils that have a thin loamy surface layer are also included. Included soils make up less than about 30 percent of any mapped area.

This Frio soil is used mainly for crops and pasture. Some areas are used for wildlife. These are mainly uncleared areas that were frequently flooded in the past. Trees are mainly elm and pecan (fig. 7).

Figure 7.—Pecan trees growing on Frio silty clay, occasionally flooded.

This soil has high potential for crops. Crop residues left on the surface help to maintain soil tilth. Cover crops and grass and legume rotations are beneficial. Drainage may be needed in some areas.

Potential for pasture is high. Good yields of bermudagrass are common on this soil.

The potential for rangeland is high. Management needs include proper stocking and deferred grazing. The potential for wildlife habitat is high.

The potential for recreational development is low. The hazard of flooding is the main limitation for camp areas. The clayey texture is the main limitation for picnic areas and playgrounds. This can be overcome by using loamy fill and maintaining a good grass cover.

This soil is in capability subclass IIw; Loamy Bottomland range site.

34—Frio silty clay, frequently flooded. This deep, nearly level soil is on flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from 25 to 700 acres. This soil is subject to flooding one to three times each year. Floodwaters are normally of low velocity and less than 4 feet deep.

Typically, the surface layer is moderately alkaline, very dark grayish brown silty clay about 9 inches thick. From 9 to 23 inches is moderately alkaline, dark grayish brown silty clay. From 23 to 64 inches is moderately alkaline, very dark grayish brown silty clay.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow. Available water capacity is high. The hazard of flooding limits the use of this soil to crops and structures that are not affected by overflow water. The soil is difficult to work when the moisture content is high.

Included in mapping are small areas of Gowen, Ovan, and Trinity soils. Gowen soils are in the slightly higher landscape positions and Ovan and Trinity soils are in the lower landscape positions. Some areas of Frio soils that have 8 to 10 inches of loamy deposits on the surface are included. The included areas make up less than about 30 percent of any one mapped area.

This Frio soil is used mainly for pasture, rangeland, and wildlife. Uncleared areas of elm, hackberry, and pecan trees are used mainly for wildlife.

The potential for pasture is high. The soil is suited to common and improved bermudagrass. It also supports good stands of clover.

The potential for rangeland is high. Management needs include proper stocking and deferred grazing. Brush management may be needed in some areas.

The potential for crops is low because of the hazard of flooding. Crops should be restricted to those that can be grown after the spring rains. Levees could be used to protect some areas from flooding.

The potential is low for most recreational use because of the hazard of flooding.

The potential for wildlife habitat is medium. Food crops for wildlife are difficult to establish; however, grain and seed crops could be planted in upland areas adjoining the flood plain.

This soil is in capability subclass Vw; Loamy Bottomland range site.

35—Gasil fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on slight convex ridges and areas that have a smooth surface. Soil areas are mainly rounded and range from 10 to about 120 acres.

Typically, the surface layer is about 7 inches of neutral, brown fine sandy loam. From 7 to 16 inches is neutral, brown sandy clay loam. From 16 to 57 inches is medium acid, light yellowish brown sandy clay loam with strong brown mottles. From 57 to 80 inches is neutral, mottled light brownish gray, strong brown, and red clay.

This soil is well drained. Runoff is slow, and permeability is moderate. Available water capacity is high. The hazard of erosion is medium. Response to fertilizer is good, and the soil is easily worked.

Included in mapping are small areas of Callisburg and Konsil soils. Callisburg soils are mainly on the lower parts of the landscape. Konsil soils are on the slightly higher ridges. Some formerly cultivated areas have a thin sandy surface layer. Included soils make up less than about 20 percent of any mapped area.

This Gasil soil is used mainly for pasture, and its potential for pasture is medium. Some fields are planted to peanuts. There is urban development in areas near cities.

The potential for crops is high on this soil, but only a few areas are cultivated because the mapped areas are small. Crop residues left on the soil surface help conserve moisture and maintain the level of organic matter. Terraces and contour farming are needed to reduce erosion.

This soil has medium potential for rangeland. Management needs include proper stocking and controlled grazing. Brush management may be needed in some areas.

The potential for recreational development is high. Trees and permanent grass can be established in recreational areas. The potential for wildlife habitat is high.

This soil is in capability subclass IIe; Sandy Loam range site.

36—Gasil fine sandy loam, 3 to 8 percent slopes. This deep, gently sloping to sloping soil is on convex ridges and side slopes. Soil areas are mainly longer than they are wide and range from 8 to 70 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 9 inches thick. From 9 to 57 inches is medium acid, brownish yellow fine sandy loam with strong brown mottles in the lower part. From 57 to 64 inches is medium acid, strong brown, brown, and gray sandy clay loam.

This soil is well drained. Runoff is slow, and permeability is moderate. Available water capacity is high. The hazard of erosion is severe when slopes are bare. This soil is easily worked, and response to fertilizer is good.

Included in mapping are small areas of Konsil and Silstid soils. Konsil soils are mainly on the higher parts of the landscape. The sandy Silstid soils are mainly on the tops of the narrow ridges. Some soils similar to the Gasil soil that have a sandy surface layer are included along fence rows of formerly cultivated areas. Included soils make up less than about 20 percent of any mapped area.

This Gasil soil is used mainly for pasture, and its potential for this use is medium. This soil is well suited to common and improved bermudagrass. Some areas are in native stands of post oak with an understory of greenbrier and range grasses.

This soil has medium potential for crops. Erosion is the main limitation. Terracing and contour farming are needed to reduce soil loss. Crop residues and cover crops are beneficial in maintaining the level of organic matter.

The potential for rangeland is medium. Management needs include proper stocking and controlled grazing.

Potential for recreational development is high. Slopes are a limitation when using this soil as a playground. Potential for wildlife is high. Grain and seed crops are easily established as food for wildlife. A wide variety of trees and grasses are suited to this soil.

This soil is in capability subclass IVe; Sandy Loam range site.

37—Gasil-Urban land complex, 1 to 4 percent slopes. This complex is made up of gently sloping soils and urban land on convex ridges and side slopes. Soil areas have a smooth surface and range from 10 to about 250 acres.

Gasil soils make up 40 to 80 percent of this complex, Urban land 20 to 40 percent, and other soils make up less than 25 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

Typically, the Gasil soil has a neutral, brown fine sandy loam surface layer about 7 inches thick. From 7 to 16 inches is neutral, brown sandy clay loam. From 16 to 47 inches is medium acid, yellowish brown sandy clay loam. From 47 to 64 inches is slightly acid, strong brown, brown, and red clay loam.

Gasil soils are well drained. Runoff is slow, and permeability is moderate. Available water capacity is high.

Urban land is covered by individual dwellings and adjoining streets, sidewalks, and driveways along with neighborhood businesses and their paved parking lots. Some areas have been cut and filled or otherwise altered so that classification of the soil is not practical.

Included with this complex in mapping are small areas of Callisburg and Konsil soils.

Potential for recreational use is high. Slope is a limitation if the complex is used for playgrounds.

This complex is not placed in a capability subclass or range site.

38—Gasil and Konsil soils, 1 to 5 percent slopes. This map unit consists of deep, gently sloping soils that have had the surface layer removed for resource material. Soil areas are square or subrounded and average about 15 acres.

Some mapped areas of this unit are dominantly Gasil soils, other areas are dominantly Konsil soils, and some areas are both Gasil and Konsil soils. The surface layer and, in some areas, the upper part of the subsoil have been removed for resource material. A very thin loamy or sandy overwash is in some areas. These soils are not uniform in extent and do not occur in a regular pattern.

Typically, Gasil soils have a medium acid, yellowish brown sandy clay loam surface layer about 10 inches thick. From 10 to 45 inches is medium acid, yellowish brown sandy clay loam with strong brown mottles. From 45 to 60 inches is medium acid, yellowish brown, brown, red, and light brownish gray clay.

Konsil soils typically have a slightly acid, yellowish red sandy clay loam surface layer about 9 inches thick. From 9 to 47 inches is medium acid, reddish yellow sandy clay loam with red mottles in the lower part. From 47 to 60 inches is medium acid, reddish yellow, strong brown, and red sandy clay loam.

These soils are well drained, but most areas receive runoff water from the higher surrounding undisturbed soils. Permeability is moderate, and available water capacity is high. The hazard of erosion is severe. Vegetation is sparse in most areas. Fertilizer and organic matter need to be added when these soils are vegetated.

Included in mapping are areas of Silstid soils from which the surface layer has been removed. These are mainly on the higher parts of the landscape. Included soils make up less than about 20 percent of any mapped area.

Most of this map unit is not being used. Some areas have sparse stands of annual weeds and grasses.

The potential for pasture is medium. Revegetation is needed, and extra fertilizer is essential to maintain good stands of grass.

The potential for crops and range is low. The areas used as rangeland require reseeding. High residue crops and extra fertilizing of the soil surface are needed for crop production. Crops in the lower areas can be damaged by standing water after rains.

Potential for recreational development is medium. Establishing vegetation is difficult and requires extra fertilizer and frequent watering.

This map unit is in capability subclass IVe; Sandy Loam range site.

39—Gowen clay loam, occasionally flooded. This deep, nearly level soil is on flood plains of major streams. Soil areas are long and narrow and range from 12 to 100 acres.

Typically, the surface layer is about 5 inches of neutral, dark grayish brown clay loam. From 5 to 23 inches is neutral, very dark grayish brown clay loam with a few streaks of very pale brown sand. From 23 to 45 inches is neutral, brown clay loam with brownish yellow mottles. From 45 to 65 inches is moderately alkaline, brown clay loam with a few dark brown loam strata.

This soil is well drained. Runoff is slow. Permeability is moderate. Available water capacity is high. The soil is subject to flooding about once each 5 to 10 years for periods of generally less than 2 days. Response to fertilizer is good and the soil is productive. The root zone is deep and easily penetrated by plant roots.

Included in mapping are small areas of Bunyan and Frio soils. Bunyan soils are in the slightly higher positions on the flood plain. Frio soils are in the low positions along side streams. Some included soils are similar to the Gowen soil but have a thin sandy surface layer. Included soils make up less than about 20 percent of any mapped area.

This Gowen soil is used mainly for pasture and meadows. The potential for pasture is high. This soil is well suited to bermudagrass.

The potential for crops is high. Crop residues left on the soil surface help maintain soil tilth. Surface drainage is beneficial in some of the low lying areas.

Potential for rangeland is high. Management needs include deferred grazing and proper stocking.

The potential is medium for most recreational development because of the flood hazard. The potential for camp areas is low.

Potential is high for wildlife habitat. This soil is well suited to grain and food crops. Native trees in undisturbed areas are attractive and provide cover for wildlife.

This soil is in capability subclass IIw; Loamy Bottomland range site.

40—Gowen clay loam, frequently flooded. This deep, nearly level soil is on flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are mainly long and narrow, and range from 10 to about 100 acres. This soil is flooded one to three times in most years for a period of 1 to 2 days.

Typically, the surface layer is mildly alkaline, dark grayish brown clay loam about 37 inches thick. From 37 to 43 inches is mildly alkaline, dark grayish brown clay loam. From 43 to 60 inches is moderately alkaline, grayish brown clay loam.

This soil is well drained. Runoff is slow and permeability is moderate. Available water capacity is high. Flooding is a major hazard. Floods occur mainly in spring. Response to fertilizer is good.

Included in mapping are small areas of Bunyan soils. Bunyan soils are in the slightly higher positions on the flood plain. Some soils similar to the Gowen soil that have a stratified sandy and loamy surface layer are included. Inclusions make up less than about 25 percent of any mapped area.

This Gowen soil is used mainly for pasture, and the potential for forage is high. Some uncleared areas are used for wildlife. The potential is medium for most kinds of wildlife habitat.

Potential for rangeland is high. Controlled grazing is the main management need.

Potential for crop and recreational development is low because of the hazard of flooding.

This soil is in capability subclass Vw; Loamy Bottomland range site.

41—Heiden clay, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. Soil areas are mainly subrounded and range from 12 to about 100 acres. In undisturbed areas, the surface is characterized by microknolls and microdepressions. The microknolls are 3 to 10 inches higher than microdepressions and their centers are 10 to 20 feet apart.

Typically, this soil, in the center of the microdepression, has a surface layer of moderately alkaline, dark grayish brown clay about 17 inches thick. From 17 to 48 inches is moderately alkaline, grayish brown clay. From 48 to 66 inches is moderately alkaline, light olive brown clay with olive yellow mottles. From 66 to 80 inches is moderately alkaline, mottled olive yellow, gray, and brownish yellow silty clay.

This soil is well drained. Runoff is rapid. Permeability is very slow. Available water capacity is high. The hazard of erosion is moderate. This soil is difficult to work during extremes in the moisture content. Continuous tillage at the same depth and tillage when the soil is wet cause a plowpan to develop, which slows movement of roots, air, and water.

Included in mapping are small areas of Houston Black soils. These soils are mainly in the lower, less sloping areas. Inclusions make up less than about 20 percent of any one mapped area.

This Heiden soil is used for crops, pasture, and range and has a high potential for these uses. Cropland areas need terraces, and farming should be done on the contour to reduce the hazard of erosion. Cover crops are beneficial in maintaining soil tilth. Crop residues left on the soil surface help maintain the level of organic matter.

The potential for recreational development is low. The clayey texture and very slow permeability of the soil are the main limitations. Areas used for recreation need a good grass cover and loamy fill material to overcome the clayey texture. Potential for openland wildlife habitat is high.

This soil is in capability subclass IIe; Blackland range site.

42—Heiden clay, 3 to 5 percent slopes. This deep, gently sloping soil is on convex ridgetops and the sides of ridges. Soil areas are longer than they are wide and range from 10 to about 80 acres. In undisturbed areas the surface is characterized by microrelief consisting of microknolls 3 to 8 inches higher than adjoining microdepressions. Distance from the center of the microknoll to center of the microdepression is 10 to 18 feet.

Typically, the soil in the center of a microknoll has a surface layer of moderately alkaline, very dark grayish brown clay about 7 inches thick. From 7 to 42 inches is moderately alkaline, grayish brown clay. From 42 to 64 inches is moderately alkaline, light yellowish brown clay. From 64 to 80 inches is yellow and gray shaly clay.

This soil is well drained. Permeability is very slow. Available water capacity is high. Runoff is rapid, resulting in a severe hazard of erosion. The soil is difficult to work during extremes in the moisture content. When the soil is wet, tillage causes a plowpan to develop that slows the movement of roots, air, and water.

Included with this soil in mapping are small areas of Vertel soils on ridgetops and Houston Black soils on foot slopes. Inclusions make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture and rangeland. The potential for these uses is high. Management needs for rangeland include proper stocking and controlled grazing. Brush management for mesquite trees is needed in some areas.

The potential for crops is medium, and a few fields are planted to small grain and grain sorghum. Terracing and contour farming slow runoff and reduce erosion. Crop residues left on the soil surface reduce erosion and improve soil tilth. Cover crops are beneficial in reducing erosion and improving soil tilth.

The potential for recreational development is low. The very slow permeability and clayey texture are the main limitations. Areas used for recreation can be filled with loamy material, and a good grass cover should be maintained.

This soil is in capability subclass IIIe; Blackland range site.

43—Houston Black clay, 0 to 1 percent slopes. This deep, nearly level soil is in broad, smooth upland areas. Soil areas are rounded and range from 10 to about 150 acres. In undisturbed areas the surface is characterized by microdepressions and microknolls. The microknolls are 3 to 12 inches higher than the microdepressions and their centers are 16 to 22 feet apart.

Typically, the soil in the center of the microdepression has a surface layer of moderately alkaline, very dark gray clay about 31 inches thick. From 31 to 56 inches is moderately alkaline, dark grayish brown clay. From 56 to 80 inches is moderately alkaline, mottled brownish yellow, pale brown, and light yellowish brown silty clay.

This soil is moderately well drained. Runoff is slow, and permeability is very slow. Available water capacity is high. The soil is difficult to work during extremes in the moisture content. Plowpans are easily formed if the soil is tilled when it is wet. These broad, smooth soil areas lend themselves to wide-scale farming operations.

Included in mapping are small areas of Branyon and Burleson soils. The Branyon soils are on the slightly lower parts of the landscape. The Burleson soils are within the areas of the Houston Black soils. Included soils make up less than about 20 percent of any mapped area.

This Houston Black soil is used mainly for row crops and small grain. The potential for crops is high. Crop residues left on the soil surface help maintain soil tilth and the level of organic matter. Cover crops in rotation are beneficial. Surface drainage may be needed in some areas.

This soil has high potential for pasture, and some formerly cultivated areas have been planted to common or improved bermudagrass.

The potential for rangeland is high. Management needs include range seeding in most native grass areas. Proper stocking and controlled grazing are also needed.

Potential for recreational development is low. The clayey texture and very slow permeability of the soil are the major limitations. Recreational areas need a good grass cover. Loamy fill material is helpful.

This soil is in capability subclass IIw; Blackland range site.

44—Houston Black clay, 1 to 3 percent slopes. This deep, gently sloping soil is in broad, smooth upland areas. Soil areas are mainly longer than they are wide and range from 10 to about 150 acres. In undisturbed areas the surface is characterized by microknolls and microdepressions that are oriented up and down the slope. The microknolls are 3 to 12 inches higher than the microdepressions and their centers are 14 to 20 feet apart.

Typically, this soil in the center of a microdepression has a surface layer of moderately alkaline, very dark gray clay about 33 inches thick. From 33 to 65 inches is moderately alkaline, dark grayish brown clay.

This soil is moderately well drained. Runoff is medium. Permeability is very slow. Available water capacity is high. The hazard of erosion is moderate. The soil is difficult to work when it is wet or extremely dry. Plowpans are easily formed if the soil is worked when wet. This soil is farmed with the surrounding large areas of arable soils that lend themselves to broad scale farming.

Included in mapping are areas of Burleson and Heiden soils. The Burleson soils are in the lower positions on the landscape. Heiden soils are on slight, convex ridges. Included soils make up less than about 25 percent of any mapped area.

This Houston Black soil is used for crops and pasture. The potential for crops is high. Crop residues left on the soil surface help maintain the level of organic matter and soil tilth. Terracing and contour farming are needed to reduce runoff and control soil erosion.

Potential for pasture is high. Some formerly cultivated fields have been planted to common or improved bermudagrass.

Potential for rangeland is high. Most native grass areas need reseeding with better quality grasses. Proper stocking and controlled grazing are needed.

The potential for recreational use is low. Very slow permeability and clayey texture are the main limitations.

This soil is in capability subclass IIe; Blackland range site.

45—Justin fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is in valley fill areas. Soil areas are subrounded and range from 7 to about 140 acres.

Typically, the surface layer is slightly acid, dark brown fine sandy loam about 14 inches thick. From 14 to 35 inches is slightly acid, brown clay loam with yellowish brown mottles. From 35 to 51 inches is neutral, yellowish brown sandy clay loam with reddish brown mottles. From 51 to 64 inches is moderately alkaline, yellowish brown, strong brown, and gray sandy clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow. Available water capacity is high. The soil is suited to a wide variety of plants. Response to fertilizer is good, and the loamy surface layer is easily worked.

Included in mapping of this soil are small areas of Gasil and Navo soils. Gasil soils are in gently sloping areas. The Navo soils are on the slightly lower parts of the landscape. Included soils make up less than about 20 percent of any mapped area.

This Justin soil is used for crops, pasture, and urban development. The soil has high potential for crops, and it is capable of high production of row crops. Some areas are planted to peanuts and truck crops. Good management includes leaving crop residues on the soil surface to maintain soil tilth and the level of organic matter. Cover crops are also beneficial.

Potential for pasture is high. This soil is suited to common and improved bermudagrass. Kleingrass is planted in some areas.

This soil has high potential for rangeland. Management needs include proper stocking and controlled grazing. Potential for openland wildlife is high.

Potential for recreational development is high. Moderately slow permeability is a limitation for camp areas and playgrounds. Drainage may be needed in these areas.

This soil is in capability class I; Sandy Loam range site.

46—Justin fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on plane to convex foot slopes. Soil areas are mainly subrounded and range from 10 to about 100 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 12 inches thick. From 12 to 17 inches is slightly acid, brown sandy clay loam with red mottles. From 17 to 33 inches is neutral, reddish yellow clay loam with red mottles. From 33 to 80 inches is mildly alkaline, brownish yellow clay loam with yellowish red mottles.

This soil is well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is high. The hazard of erosion is moderate. Response to fertilizer is good, and the soil is easily worked. Roots can easily penetrate the lower layers, and a wide variety of plants are suited to this soil.

Included in mapping are small areas of Callisburg, Gasil, and Navo soils. Callisburg and Navo soils are in the lower positions on the landscape. Gasil soils are on convex ridges and slopes near the outer edges of areas of Justin soil. Included soils make up about 20 percent of any mapped area.

This Justin soil is used mainly for pasture. The potential for pasture is high. Among the grasses suited to this soil are common bermudagrass, improved bermudagrass, and kleingrass.

The potential for crops is high, and a few fields are planted to row crops and small grain. Peanuts are grown in some areas. Crop residues left on the soil surface help maintain the level of organic matter. Terracing and contour farming are needed to control erosion. Cover crops are beneficial.

Potential for rangeland is high. Management needs include proper stocking and controlled grazing.

Potential for recreational development is high. Moderately slow permeability is the main limitation for camp areas and playgrounds. The potential for openland wildlife habitat is high.

This soil is in capability subclass IIe; Sandy Loam range site.

47—Justin fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex narrow bands on the lower part of foot slopes of ridges. Soil areas are longer than they are wide and range from 7 to about 40 acres.

Typically, the surface layer is about 10 inches of slightly acid, dark brown fine sandy loam. From 10 to 15 inches is slightly acid, brown sandy clay loam. From 15 to 20 inches is neutral, brown clay loam. The next layer, extending from 20 to 55 inches, is neutral, mottled yellowish red and strong brown clay loam. From 55 to 80 inches is mildly alkaline, mottled yellowish red and reddish brown clay loam.

This soil is well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is high.

The hazard of erosion is moderate. Response to fertilizer is good, and the soil is easily worked.

Included in mapping are small areas of Navo soils. Navo soils are on the higher convex slopes along the upper edges of the Justin soils. Some soils similar to the Justin soils are included that have a thinner surface layer.

This Justin soil is used as pasture and rangeland. The potential for pasture is high, and potential for rangeland is high. Management needs for rangeland include proper stocking and deferred grazing.

The potential for crops is medium. Terraces and contour farming are needed to control erosion. Crop residues and cover crops are needed to slow runoff and help maintain soil tilth and the level of organic matter.

This soil has high potential for recreational development. Moderately slow permeability is a limitation when this soil is used for camp areas and playgrounds. Potential for openland wildlife habitat is high.

This soil is in capability subclass IIIe; Sandy Loam range site.

48—Justin-Urban land complex, 0 to 3 percent slopes. This complex is made up of nearly level and gently sloping soils in valley fill areas. Soil areas are longer than they are wide and range from about 12 to 150 acres.

Justin soils make up 40 to 60 percent of the unit, Urban land 20 to 40 percent, and other soils make up less than 30 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Justin soil has a surface layer of slightly acid, dark brown fine sandy loam about 12 inches thick. From 12 to 17 inches is slightly acid, reddish brown and red sandy clay loam. From 17 to 64 inches is neutral, yellowish brown clay loam with red mottles.

Justin soils are well drained. Permeability is moderately slow. Surface runoff is medium. Available water capacity is high. Low areas receive runoff water during periods of high rainfall. In areas that are more sloping there is a moderate hazard of erosion. The soil has a wide variety of plants and grasses suitable for landscaping. The soil is easily worked, and plant response is good.

Urban land is covered by individual dwellings, neighborhood businesses, sidewalks, driveways, and streets. Some areas have been filled or otherwise altered so that classification of the original soil material is not practical. In most areas the original loamy surface layer was removed when streets were constructed, and the soil material was spread over the adjoining area.

Included in mapping are mainly areas of Callisburg and Gasil soils.

The potential for recreational areas is high. Moderately slow permeability limits some playground and camp uses.

This complex is not placed in a capability subclass or range site.

49—Kaufman clay, frequently flooded. This deep, nearly level soil is on the lower parts of the landscape and in the outer edges of the flood plains of major streams draining from clayey areas. Soil areas are long and narrow and range from about 22 to 200 acres. The soil is subject to flooding one or more times each year for a period of up to 5 days duration.

Typically, the surface layer is about 5 inches of mildly alkaline, dark gray clay. From 5 to 34 inches is mildly alkaline, dark gray clay with very dark grayish brown mottles. From 34 to 57 inches is moderately alkaline, gray clay with vertical streaks of brown and black. From 57 to 64 inches is moderately alkaline, dark grayish brown clay.

This soil is somewhat poorly drained. Runoff is slow, and permeability is very slow. Available water capacity is high. The soil is difficult to work. Plant roots have difficulty penetrating the dense clay subsoil. Wetness inhibits plant growth during wet seasons.

Included in mapping of this soil are small areas of Gowen and Ovan soils. Gowen soils are on the higher landscape positions along the drains and side channels. Ovan soils are on slight benches above Kaufman soils. These included soils make up less than about 30 percent of any mapped area.

This soil is used for pasture and wildlife. Potential is high for pasture. The soil is suited to common and improved bermudagrass, and some areas are planted to fescue grass. Grazing should be restricted to dry seasons.

Potential for crops is low because of the hazard of flooding during the growing season.

Potential for rangeland is high. Management needs include proper stocking and controlled grazing. Grazing should be restricted to dry seasons.

This soil has low potential for recreational use. Very slow permeability and clayey texture are the main limitations for recreational use.

The potential for wildlife habitat is medium. Shallow water areas can be established to encourage wetland wildlife.

This soil is in capability subclass Vw; Clayey Bottomland range site.

50—Konsil fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex ridges and side slopes. Soil areas are subrounded and range from 6 to about 150 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 12 inches thick. From 12 to 21 inches is slightly acid, yellowish red sandy clay loam. From 21 to 32 inches is slightly acid, reddish yellow sandy clay loam. From 32 to 66 inches is medium acid, reddish

yellow sandy clay loam with red and reddish yellow mottles.

This soil is well drained. Runoff is slow. Permeability is moderate. Available water capacity is high. Erosion is a moderate hazard. The root zone is deep and easily penetrated. Response to fertilizer is good and the soil is easily worked. Plants are easily established on this soil.

Included in mapping are small areas of Birome, Gasil, and Silawa soils. Birome soils are on the slightly higher ridges. Gasil soils mainly are on the lower parts of the landscape. Silawa soils are on the tops of ridges within areas of the Konsil soils. Included soils make up less than about 25 percent of any mapped area.

This soil is used mainly for pasture, and it has high potential for pasture.

The potential is high for crops, and a few fields are planted to grain sorghum and peanuts. Terracing and contour farming are needed on this soil to reduce erosion. Crop residues left on the soil surface reduce erosion and help maintain the level of organic matter.

Potential for rangeland is medium. Management needs include proper stocking and controlled grazing.

Potential for recreational development is high. Good stands of grass are needed and are easily established. Potential for wildlife use is high.

This soil is in capability subclass IIe; Sandy Loam range site.

51—Konsil fine sandy loam, 3 to 8 percent slopes. This deep, gently sloping to sloping soil is on convex ridges and sides of ridges. Soil areas have a smooth surface, are mainly longer than they are wide, and range from about 8 to 90 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 12 inches thick. From 12 to 23 inches is neutral, yellowish red sandy clay loam. From 23 to 37 inches is medium acid, red sandy clay loam. From 37 to 52 inches is medium acid, strong brown sandy clay loam with yellowish brown mottles. From 52 to 64 inches is slightly acid, yellowish brown sandy clay loam with strong brown mottles.

This soil is well drained. Runoff is slow. Permeability is moderate. Available water capacity is high. The hazard of erosion is moderate. Response to fertilizer is good and the soil is easily worked. The rooting zone is deep and easily penetrated by plant roots.

Included in mapping are small areas of Birome and Gasil soils. Birome soils are on the higher convex ridges underlain by sandstone. Gasil soils are on the lower parts of the landscape within areas of the Konsil soils. Sandy Silawa soils are included in some areas. Included soils make up less than about 20 percent of any mapped area.

This soil is used mainly for pasture, and its potential for pasture is medium. Common and improved bermudagrass are the main grasses grown on this soil.

Potential is medium for crops on this soil. Terraces and contour farming are necessary to reduce erosion. Crop residues left on the soil surface conserve moisture and improve productivity.

Potential for rangeland is medium. Management needs include proper stocking and controlled grazing.

Potential for most recreational use is high. The potential for playgrounds is medium because of the soil slope. The potential is high for most types of wildlife. Potential is low for wetland wildlife because wet areas are difficult to establish on this soil.

This soil is in capability subclass IVe; Sandy Loam range site.

52—Lewisville clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on plane to convex high terraces of major streams. Soil areas are mainly subrounded and range from 10 to 35 acres.

Typically, the surface layer is moderately alkaline, brown clay loam about 6 inches thick. Between the depths of 6 and 17 inches is moderately alkaline, dark grayish brown clay loam. From 17 to 38 inches is moderately alkaline, grayish brown silty clay. From 38 to 64 inches is moderately alkaline, brownish yellow silty clay.

This soil is well drained. Surface runoff is slow. Permeability is moderate. Available water capacity is high. The hazard of erosion is moderate. Chlorosis occurs in some plants grown on this soil. Areas underlain by sand and gravel are strip mined.

Included in mapping are small areas of Altoga and Heiden soils. The Altoga soils are in the more sloping areas. The Heiden soils are above the Lewisville soils on the landscape. Included soils make up less than 20 percent of any mapped area.

This soil is used mainly for pasture and crops, and potential for these uses is high. Crop residues are left on the soil surface to maintain productivity. Terraces and contour farming reduce erosion.

Rangeland potential is high. Management needs include proper stocking and controlled grazing.

The potential for recreational development of this soil is medium because the surface layer is clayey. Areas used for recreation can be filled with loamy material and a good stand of grass can be established to help overcome this limitation. Potential for most kinds of wildlife habitat is medium.

This soil is in capability subclass IIe; Clay Loam range site.

53—Lewisville clay loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex high terraces of major streams. Soil areas are mainly longer than they are wide and range from about 7 to 30 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam about 15 inches thick. From 15 to 37 inches is moderately alkaline, grayish brown silty clay. From 37 to 56 inches is moderately alkaline, light

olive brown silty clay. From 56 to 74 inches is moderately alkaline, light yellowish brown silty clay.

This soil is well drained. Permeability is moderate. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is severe. Chlorosis occurs in some plants grown on this soil. Areas underlain by sand and gravel are strip mined.

Included in mapping are small areas of Altoga and Ferris soils. The Altoga soils are in slightly eroded areas and on the higher parts of the landscape. The Ferris soils are in areas above the Lewisville soils. Included soils make up less than about 20 percent of any mapped area.

This soil is used mainly for pasture. Common and improved bermudagrass are the main grasses grown on this soil. Potential for pasture is high.

The potential is high for crops. Erosion is the main limitation. Terraces and contour farming are needed to reduce the hazard of erosion. Crop residues left on the soil surface reduce runoff and help maintain the level of organic matter. Close-spaced high residue crops are beneficial.

Potential is high for rangeland. Management needs include proper stocking and controlled grazing.

Potential for recreational development is medium because of the clay loam surface layer. Areas used for recreation can be filled with sandy material and maintained in a good grass cover to help overcome this limitation. Potential for most wildlife habitat is medium.

This soil is in capability subclass IIIe; Clay Loam range site.

54—Lindale clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex ridges. Soil areas have a smooth surface and are subrounded. They range from about 8 to 70 acres.

Typically, the surface layer is slightly acid, brown clay loam about 6 inches thick. From 6 to 16 inches is mildly alkaline, reddish brown clay. From 16 to 25 inches is moderately alkaline, brown clay. From 25 to 32 inches is moderately alkaline, brown clay with strong brown mottles. From 32 to 43 inches is moderately alkaline, light brown very gravelly clay that is about 60 percent limestone gravel and cobbles. From 43 to 65 inches is moderately alkaline, reddish yellow gravelly clay that is about 20 percent limestone gravel and cobbles.

This soil is well drained. Runoff is medium. Permeability is slow. Available water capacity is medium. The hazard of erosion is moderate. Rooting depth is somewhat limited by the gravelly lower layers.

Included in mapping are small areas of Mingo and Ponder soils. The Mingo soils are on the slightly lower parts of the landscape. Ponder soils are in broad valley fill areas. Included soils make up less than about 15 percent of any mapped area.

This Lindale soil is used for pasture, crops, and rangeland. Potential for pasture is medium.

Potential for crops is medium. Crop residues left on the soil surface conserve moisture. Terracing and contour farming are needed to help control erosion.

Potential is high for rangeland. Management needs include proper stocking and controlled grazing. Brush management is needed in some areas.

Potential for recreational use is medium. Slow permeability and clay loam texture are the main limitations.

This soil is in capability subclass IIIe; Deep Redland range site.

55—Lindale-Urban land complex, 1 to 5 percent slopes. This gently sloping complex is on convex ridges. Soil areas have a smooth surface and are subrounded. They range from about 15 to 100 acres.

Lindale soils make up 40 to 60 percent of the unit, Urban land 20 to 30 percent, and included soils less than 35 percent. The components of this complex are so intermixed that separation is not practical at the scale mapped.

The Lindale part of this complex has a slightly acid, brown clay loam surface layer about 6 inches thick. From 6 to 16 inches is mildly alkaline, reddish brown clay. From 16 to 25 inches is moderately alkaline, brown clay. From 25 to 32 inches is moderately alkaline, brown clay with strong brown mottles. Between 32 and 43 inches is moderately alkaline, light brown very gravelly clay that is about 60 percent limestone gravel and cobbles. From 43 to 65 inches is moderately alkaline, reddish yellow gravelly clay that is about 20 percent limestone gravel and cobbles.

Lindale soils are well drained. Runoff is medium. Permeability is slow. Available water capacity is medium. The hazard of erosion is moderate. Rooting depth is somewhat limited by the gravelly lower layers. The soil surface is hard and crusty when dry.

Urban land is covered by individual dwellings and adjoining streets, driveways, sidewalks, and patios. Small neighborhood businesses are also present. Some areas have been disturbed or altered so that classification of the soil material is not practical.

Included with this complex in mapping are mainly areas of Bolar and Speck soils.

This complex is not placed in a capability subclass or range site.

56—Medlin-Sanger clays, 5 to 15 percent slopes. These sloping to moderately steep soils are on sides of ridges. Soil areas are mainly longer than they are wide and range from 10 to 150 acres. Untilled areas are characterized by microknolls 3 to 8 inches higher than microdepressions. The microknolls extend up and down the slope and are 6 to 20 feet wide.

About 60 percent of this complex is Medlin soils, about 30 percent is Sanger soils, and about 10 percent other soils. The soils occur in patterns too intricate to be delineated at the scale mapped. Medlin soils are mainly

on the higher parts of the landscape and on microknolls. Sanger soils are on the lower parts of the landscape and in microdepressions.

Medlin soils are moderately alkaline. The surface layer typically is grayish brown clay about 30 inches thick. Between the depths of 30 and 49 inches is grayish brown silty clay with yellowish brown mottles. From 49 to 70 inches is grayish brown marly silty clay with yellowish brown and gray mottles.

Sanger soils are moderately alkaline. They typically have a surface layer of dark grayish brown clay about 19 inches thick. From 19 to 38 inches is grayish brown clay. From 38 to 55 inches is light olive brown clay. From 55 to 80 inches is light yellowish brown clay with yellowish brown and gray mottles.

The soils in this complex are well drained. Permeability is very slow. Available water capacity is high. Runoff is rapid, and the hazard of erosion is severe. The soil is difficult to work during extremes in the moisture content.

Included in mapping are small areas of Frio and Slidell soils along narrow flood plains and valley fills.

This complex is used as rangeland, and the production potential is high. Management needs include proper stocking and controlled grazing.

This complex is unsuitable for crops because of slope and erodibility. Potential for pasture is low.

Potential for recreational development is low because of slope and clayey texture.

This complex is in capability subclass VIe; Blackland range site.

57—Medlin-Sanger stony clays, 5 to 12 percent slopes. These sloping to strongly sloping soils are on convex side slopes with limestone rock strata at each 10 to 20 feet of change in elevation. Soil areas are longer than they are wide and range from 8 to about 200 acres. The surface is characterized by microknolls 3 to 10 inches higher than microdepressions. Microknolls are 5 to 20 feet wide.

About 45 percent of this complex is made up of stony Medlin soils, about 25 percent is stony Sanger soils, and 30 percent is other soils and rock outcrop. These soils are so intricately mixed that separation is not practical at the scale mapped.

Medlin soils are moderately alkaline. The surface layer is typically about 4 inches of very dark grayish brown stony clay. Between 4 and 26 inches is light olive brown silty clay. From 26 to 60 inches is olive yellow silty clay.

Sanger soils are moderately alkaline. The surface layer is typically about 11 inches of very dark grayish brown stony clay. From 11 to 23 inches is brown clay. From 23 to 60 inches is light yellowish brown silty clay.

The soils are well drained. Permeability is very slow. Available water capacity is high. Runoff is rapid, and the hazard of erosion is severe. Stones in and on the soil interfere with tillage. Some rocks have been worked into vertical positions by the shrinking and swelling of the soil and protrude 6 inches to 3 feet above the surface (fig. 8).

Included with this complex in mapping are small intermixed areas of Bolar and Somervell soils. These are on benches near the rock outcrops.

These soils are used as rangeland, and production potential is high. Proper stocking and controlled grazing are among the management needs.

These soils are unsuitable for pasture and crops because they contain large stones and are erodible.

Potential for recreational development is low because of the clayey surface layer and large stones.

This complex is in capability subclass VIs; Blackland range site.

58—Mingo clay loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on convex, slight ridges and side slopes between valley fills and high limestone ridges. Soil areas are subrounded and range from about 12 to 130 acres.

Typically, the surface layer is mildly alkaline, brown clay loam about 11 inches thick. Between 11 and 20 inches is mildly alkaline, brown clay. From 20 to 29 inches is moderately alkaline, reddish brown clay. From 29 to 33 inches is fractured, platy limestone interbedded with marly clay.

This soil is well drained. Runoff is medium. Permeability is very slow. Available water capacity is low. The limited rooting depth and low available water reduce productivity. The soil is difficult to work during extremes in the moisture content.

Included in mapping are small areas of Lindale, Ponder, and Sanger soils. Lindale soils are on outer edges of the mapped areas. The Ponder and Sanger soils are on the lower parts of the landscapes in valley fill areas. Included soils make up less than about 20 percent of any mapped area.

This Mingo soil is used mainly for crops and rangeland. Some cultivated areas are planted to improved pasture. Potential for pasture is medium.

Potential for crops is medium. The best suited crops are those grown during winter months when moisture is best. Residues from crops left on the soil surface help improve soil tilth and conserve moisture.

Rangeland potential is medium. Management needs include proper stocking and controlled grazing. Water for livestock can best be located on the deeper soils.

Potential for recreation is medium because of very slow permeability and the clay loam surface layer.

This soil is in capability subclass IIIe; Deep Redland range site.

59—Navo clay loam, 0 to 1 percent slopes. This deep, nearly level soil is in valley fill and terrace areas. Soil areas have a smooth surface and are subrounded. They range from about 7 to 140 acres.

Figure 8.—Medlin-Sanger stony clays, 5 to 12 percent slopes, showing rock outcrops.

Typically, the surface layer is slightly acid, dark brown clay loam about 8 inches thick. Between 8 and 24 inches is slightly acid, yellowish red clay with reddish brown mottles. From 24 to 48 inches is neutral, reddish brown, brown, gray, and yellowish brown clay. From 48 to 70 inches is moderately alkaline, yellowish brown clay with gray and olive mottles.

This soil is well drained. Runoff is medium, and permeability is very slow. Available water capacity is high. This soil receives extra runoff water from nearby soils because of its low position on the landscape. The soil is deep, and roots penetrate into the lower layers. The soil is difficult to work during dry periods.

Included in mapping are small areas of Callisburg, Justin, and Wilson soils. The Callisburg and Justin soils are on the slightly higher parts of the landscape. Wilson soils are on the lower parts of the landscape. Included soils make up less than about 15 percent of any mapped area.

This Navo soil is used mainly for crops and pasture. Its potential for pasture is high. Potential for crops is medium. Crop residues left on the soil surface conserve moisture and improve tilth.

Potential for rangeland is medium. Proper stocking and controlled grazing are needed to maintain a good stand of native plants.

Potential for recreational development is low because the soil has clay loam texture and very slow permeability. Areas used for recreation can be filled with loamy fill material and a good grass cover to help overcome the limitations.

This soil is in capability subclass IIIs; Claypan Prairie range site.

60—Navo clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on sides along the drains and low hills. Soil areas have a smooth surface and are subrounded. They range from about 10 to 100 acres.

Typically, the surface layer is about 5 inches of slightly acid, brown clay loam. Between 5 and 10 inches is medium acid, yellowish red clay. From 10 to 22 inches is medium acid, mottled weak red and reddish brown clay. From 22 to 48 inches is moderately alkaline, light brown-

ish gray clay with reddish brown mottles. From 48 to 72 inches is moderately alkaline, light yellowish brown clay with strong brown and gray mottles. From 72 to 80 inches is moderately alkaline, yellow clay with gray mottles.

This soil is well drained. Permeability is very slow. Available water capacity is high. Runoff is medium, and the hazard of erosion is high. The soil is difficult to work when it is dry. The rooting zone is deep, and roots penetrate into the lower layers.

Included in mapping are small areas of Crockett, Justin, and Wilson soils. The Crockett and Justin soils are on the slightly higher parts of the landscape. Wilson soils are mainly on the lower parts of the landscape. Included soils make up less than about 20 percent of any mapped area.

This Navo soil is used mainly for pasture and crops. Potential for pasture is high. Potential is medium for crops. Terracing and contour farming are needed to reduce erosion. Crop residues left on the soil surface slow runoff and improve soil tilth.

Potential for rangeland is medium. Proper stocking and controlled grazing are needed to maintain good stands of grass.

Potential for recreational development is low because the soil has very slow permeability and clay loam texture. Use of loamy fill material and maintaining a good grass cover help overcome these limitations.

This soil is in capability subclass IIIe; Claypan Prairie range site.

61—Navo clay loam, 3 to 5 percent slopes. This deep, gently sloping soil is on side slopes above the drains. Soil areas are mainly longer than they are wide and range from about 10 to 60 acres.

Typically, the surface layer is neutral, brown clay loam about 10 inches thick. Between 10 and 23 inches is medium acid, brown clay with red mottles. The layer from 23 to 38 inches is mildly alkaline, brown clay. From 38 to 68 inches is moderately alkaline, brownish yellow clay. From 68 to 80 inches is moderately alkaline, mottled grayish brown, light olive brown, and gray shaly clay.

This soil is well drained. Permeability is very slow. Available water capacity is high. Runoff is medium, and the hazard of erosion is severe. The root zone is deep, and roots penetrate into the lower layers.

Included in mapping are small areas of Callisburg and Justin soils. These are mainly in less sloping areas below the Navo soil. Some eroded areas are also included. Included soils make up less than about 20 percent of any one mapped area.

This Navo soil is used mainly as pasture and rangeland. Pasture potential is high. Rangeland production potential is medium. Management needs for rangeland include proper stocking and controlled grazing.

Potential for crops is medium. Terracing and contour farming are needed to slow runoff and reduce erosion. Crop residues left on the soil surface conserve moisture and improve soil tilth.

Potential for recreational development is low because the soil has very slow permeability and clay loam texture. Using a good grass cover and loamy fill will help overcome these limitations.

This soil is in capability subclass IVe; Claypan Prairie range site.

62—Navo-Urban land complex, 0 to 3 percent slopes. This nearly level to gently sloping complex is on uplands. Areas have a smooth surface and are rounded. They range from about 10 to 80 acres.

Navo soils make up 50 to 60 percent of this complex, Urban land 20 to 30 percent, and included soils less than about 35 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Navo portion of this unit has a neutral, brown clay loam surface layer about 5 inches thick. From 5 to 10 inches is medium acid, yellowish red clay. From 10 to 22 inches is medium acid, mottled red and reddish brown clay. From 22 to 72 inches is moderately alkaline, mottled brownish gray, reddish brown, and strong brown clay.

Urban land is covered by mainly individual dwellings and adjoining streets, driveways, and patios. Some areas have been scraped and filled or otherwise altered so that classification of the soil material is not practical.

Included with this complex in mapping are mainly areas of Crockett and Ponder soils.

This complex is not placed in a capability subclass or range site.

63—Ovan clay, occasionally flooded. This deep, nearly level soil is on flood plains along major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from about 50 to 600 acres. The soil is subject to flooding for short periods, about once each 5 to 10 years.

Typically, the surface layer of this soil is about 27 inches of moderately alkaline, grayish brown clay. Between 27 and 57 inches is moderately alkaline, grayish brown clay and thin layers of sandy clay. From 57 to 64 inches is moderately alkaline, grayish brown clay.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow. Available water capacity is high. The soil is difficult to work when it is wet. Response to fertilizer is good, and the soil is productive.

Included in mapping are small areas of Frio and Trinity soils. Frio soils are on the slightly higher parts of the landscape. Trinity soils are in the low, somewhat poorly drained areas. Included soils make up less than about 15 percent of any mapped area.

This Ovan soil is used for pasture and crops, and the potential for these uses is high. Crop residues left on the

soil surface improve tilth. Surface drainage may be needed in some areas.

Potential for rangeland is high. Management needs include proper stocking, controlled grazing, and brush management.

Potential for recreational use of this soil is low. Its clayey texture and the hazard of flooding are the main limitations.

This soil is in capability subclass IIIw; Clayey Bottomland range site.

64—Ovan clay, frequently flooded. This deep, nearly level soil is on flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from about 25 to 1,100 acres. Floods occur one or more times in most years. Floodwaters are mainly slow moving and shallow.

Typically, the surface layer of this soil is about 66 inches of moderately alkaline, grayish brown clay. From 66 to 80 inches is moderately alkaline, grayish brown clay with brown mottles.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow. Available water capacity is high. Floods occur mainly in spring and in fall months and limit the growth of some plants.

Included in mapping are small areas of Frio and Trinity soils. Frio soils are slightly higher on the flood plain and Trinity soils are slightly lower than the Ovan soil. Included soils make up less than about 25 percent of any mapped area.

This Ovan soil is used mainly for pasture. Common bermudagrass and hybrid sudangrass are the main forages. Potential for pasture is high.

Potential for crops is low because of flooding. Crops are limited to those that mature quickly and grow during summer months.

Potential for rangeland is high. Management needs include proper stocking, controlled grazing, and brush management. Weed control is required in most areas. Wildlife habitat potential is medium.

Potential for recreational use of the soil is low because of the hazard of flooding and clayey texture.

This soil is in capability subclass Vw; Clayey Bottomland range site.

65—Ponder loam, 0 to 1 percent slopes. This deep, nearly level soil is in broad valley fill areas. Soil areas have a smooth surface and are subrounded. They range from about 10 to 90 acres.

Typically, the surface layer is neutral, dark grayish brown loam about 6 inches thick. From 6 to 28 inches is neutral, grayish brown clay. From 28 to 55 inches is moderately alkaline, light brownish gray clay. From 55 to 70 inches is moderately alkaline, very pale brown clay.

This soil is well drained. Runoff is slow. Permeability is very slow. Available water capacity is medium. The surface layer is very hard when dry and difficult to till. The rooting zone is deep, but roots have difficulty penetrating the clayey lower layers.

Included in mapping are small areas of Burleson, Navo, and Wilson soils. Burleson soils are in the lower positions on the landscape. Navo and Wilson soils are in similar landscape positions. Included soils make up less than about 20 percent of any mapped area.

This Ponder soil is used for pasture, crops, rangeland, and urban development. Potential for pasture is high.

Potential for crops is medium. Crop residues left on the soil surface help maintain soil moisture and improve tilth.

Potential is medium for rangeland. Management needs include proper stocking and controlled grazing.

Potential for camp areas and playgrounds is low because the soil has very slow permeability. Potential for picnic areas is high.

This soil is in capability subclass IIIs; Claypan Prairie range site.

66—Ponder loam, 1 to 3 percent slopes. This deep, gently sloping soil is on low convex ridges and in valley fill areas. Soil areas have a smooth surface and are subrounded. They range from about 10 to 200 acres.

Typically, the surface layer is neutral, brown loam about 7 inches thick. From 7 to 16 inches is medium acid, brown clay. From 16 to 22 inches is slightly acid, brown clay with red mottles. From 22 to 62 inches is neutral, brown clay. From 62 to 80 inches is moderately alkaline, very pale brown clay.

This soil is well drained. Surface runoff is medium. Permeability is very slow. Available water capacity is medium. The hazard of erosion is moderate. The surface layer is very hard and difficult to till when it is dry. The rooting zone is deep, but roots have difficulty penetrating the clayey lower layers.

Included in mapping are small areas of Navo, Sanger, and Wilson soils. Navo soils are mainly on the higher ridges. The Sanger soils are on slight scarps and sides of ridges. Wilson soils are on the lower parts of the landscape and in microdepressions less than about 20 feet in diameter. Included soils make up less than about 20 percent of any one mapped area.

This Ponder soil is used for pasture, crops, rangeland, and urban development. Potential for pasture is high, and potential for rangeland is medium. Rangeland management includes proper stocking and controlled grazing.

Potential for crops is medium. Crop residues left on the soil surface conserve moisture and improve tilth. Terracing and contour farming reduce erosion.

Potential for camp areas and playgrounds is low because of very slow permeability. Potential for picnic areas is high.

This soil is in capability subclass IIIe; Claypan Prairie range site.

67—Sanger clay, 1 to 3 percent slopes. This deep, gently sloping soil is in valley fill areas between limestone ridges. Soil areas are subrounded and range from about 10 to 200 acres. Untilled areas have microknolls 6 to 20 feet wide and microdepressions 4 to 12 feet wide that extend up and down the slope. Microknolls are 3 to 10 inches higher than microdepressions.

Typically, at the center of a microdepression the surface layer of this soil is moderately alkaline, dark grayish brown clay about 38 inches thick. From 38 to 55 inches is moderately alkaline, light yellowish brown silty clay with brownish yellow mottles. From 55 to 80 inches is moderately alkaline, light yellowish brown silty clay with light gray mottles in the upper part and very pale brown mottles in the lower part.

This soil is well drained. Runoff is medium. Permeability is very slow. Available water capacity is high. The hazard of erosion is moderate. Chlorosis is a hazard in some plants grown on this soil.

Included in mapping are small areas of Burleson, Ponder, and Slidell soils. Burleson and Slidell soils are mainly in the lower positions on the landscape. The Ponder soils are on slight ridges. Included soils make up less than about 20 percent of any mapped area.

This Sanger soil is used mainly for crops, but a significant acreage is used for pasture and rangeland. Potential for pasture and rangeland is high.

Potential for crops is high. Crop residues left on the soil surface improve tilth and conserve moisture. Terracing and contour farming are needed to control erosion in row crops.

Potential for recreational use is low because the soil has very slow permeability and clayey texture.

This soil is in capability subclass IIe; Blackland range site.

68—Sanger clay, 3 to 5 percent slopes. This deep, gently sloping soil is in valley fill areas and on sides of ridges. Soil areas are longer than they are wide and range from about 10 to 130 acres. Untilled areas have microknolls that are 3 to 8 inches higher than microdepressions.

Typically, at the center of a microdepression, the surface layer of this soil is moderately alkaline, dark grayish brown clay about 17 inches thick. From 17 to 27 inches is moderately alkaline, light yellowish brown silty clay with brownish yellow mottles. From 27 to 60 inches is moderately alkaline, light yellowish brown silty clay.

This soil is well drained. Runoff is medium. Permeability is very slow. Available water capacity is high. The hazard of erosion is severe. The soil has a high calcium carbonate content, and chlorosis is a hazard in some plants.

Included in mapping are small areas of Bolar and Medlin soils. Bolar soils are on the higher ridges or on narrow bands on upper parts of the slope. Medlin soils are in more sloping areas. Included soils make up less than about 20 percent of any one mapped area.

This Sanger soil is used mainly as rangeland and pasture, but some fields are planted to small grain. Potential for rangeland and pasture is high. Management needs include proper stocking and controlled grazing.

Potential for crops is medium. Terracing and contour farming are essential to reduce erosion. Crop residues left on the surface conserve moisture, reduce runoff, and improve soil tilth.

Potential for recreational development is low because the soil has clayey texture and very slow permeability.

This soil is in capability subclass IIIe; Blackland range site.

69—Sanger-Urban land complex, 1 to 4 percent slopes. This gently sloping complex is in valley fill areas and on sides of ridges. Soil areas have a smooth surface and range from 20 to 250 acres.

Sanger soils make up 40 to 65 percent of the unit, Urban land 20 to 40 percent, and included soils less than 35 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Sanger soils are moderately alkaline and calcareous. Typically, they have a grayish brown clay surface layer about 30 inches thick. From 30 to 55 inches is light yellowish brown silty clay with yellow mottles. From 55 to 80 inches is light yellowish brown silty clay with light gray and very pale brown mottles.

Sanger soils are well drained. Permeability is very slow. The available water capacity is high. Runoff is medium, and the hazard of erosion is medium. Water should be applied at a slow rate because of the very slow permeability.

Urban land is covered mainly by individual dwellings and adjoining streets, driveways, sidewalks, and patios. Some areas have been disturbed or altered so that classification of the original soil is not practical. Most streets have been cut 10 to 20 inches below ground level, and the excavated material was spread over the adjoining soil.

Included with this complex in mapping are mainly areas of Burleson and Slidell soils which are in the lower landscape positions.

This complex is not placed in a capability subclass or range site.

70—Seagoville clay, occasionally flooded. This deep, nearly level soil is on slight ridges and outer reaches of flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas have a smooth surface and are longer than they are wide. They range from 15 to 180 acres. The soil is subject to flooding about once each 5 to 10 years.

Typically, the surface layer is moderately alkaline, dark grayish brown clay about 28 inches thick. From 28 to 37

inches is moderately alkaline, dark brown sandy clay loam with yellowish brown mottles. From 37 to 80 inches is mildly alkaline, brownish yellow loamy sand with dark brown mottles.

This soil is moderately well drained. Runoff is slow. Permeability is very slow. Available water capacity is medium.

Included in mapping are small areas of Frio and Trinity soils. These are in the lower positions on the flood plain and lack sandy or loamy lower layers. Some small areas of the Arents soils, hilly, are included as areas that have been stripped and mined for resource material. Included soils make up less than 10 percent of any mapped area.

This Seagoville soil is used for pasture or is mined for sand and gravel. These resource materials are below a depth of 4 feet. Some of the mined areas have been smoothed and planted to improved bermudagrass. Potential for pasture is high.

Potential for crops is high. Crop residues left on the soil surface help improve soil tilth.

Potential is high for rangeland. Management needs include proper stocking and controlled grazing. Brush management is needed in some areas.

Potential for recreational use is low because the soil has clayey texture and very slow permeability.

This soil is in capability subclass IIw; Clayey Bottomland range site.

71—Silawa loamy fine sand, 2 to 5 percent slopes. This deep, gently sloping soil is on high convex ridges. Soil areas have a smooth surface and are subrounded. They range from 5 to 90 acres.

Typically, the surface layer is about 14 inches of slightly acid, light brown loamy fine sand. From 14 to 27 inches is slightly acid, red sandy clay loam. From 27 to 39 inches is medium acid, red sandy clay loam. From 39 to 56 inches is medium acid, reddish yellow sandy clay loam with red mottles. From 56 to 60 inches is medium acid, mottled brownish yellow and red loamy fine sand.

This soil is well drained. Runoff is slow. Permeability is moderate. Available water capacity is medium. Soil blowing is a hazard when the soil is left bare.

Included in mapping are small areas of Konsil and Silstid soils. Konsil soils are in slight depressions. Silstid soils are on the lower parts of the landscape. Included soils make up less than about 20 percent of any mapped area.

This Silawa soil is used mainly for pasture. Potential for pasture is high. This soil is suited to common and improved bermudagrass.

Potential for crops is medium. Crop residues left on the soil surface reduce soil blowing and conserve moisture.

Potential for rangeland is medium. Good stands of native grass can be maintained by proper stocking and controlled grazing.

Potential is medium for recreational use because of the sandy surface layer. A good vegetative cover is needed to reduce soil blowing.

This soil is in capability subclass IIIe; Loamy Sand range site.

72—Silstid loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is on gently undulating ridges and sides of ridges. Soil areas have a smooth surface and are subrounded. They range from 7 to about 150 acres.

Typically, the surface layer is neutral, brown loamy fine sand about 6 inches thick. From 6 to 30 inches is slightly acid, very pale brown loamy fine sand. From 30 to 72 inches is medium acid, brownish yellow sandy clay loam with brownish, grayish, and reddish mottles. From 72 to 80 inches is slightly acid, mottled red, light gray, and brownish yellow loamy fine sand.

This soil is well drained. Surface runoff is slow. Permeability is moderate. Available water capacity is medium. Soil blowing is a hazard when the soil is bare. The surface layer is droughty, and plant growth is slow until roots penetrate the lower layers.

Included in mapping are small areas of Gasil and Silawa soils. Gasil soils are in slight depressions. Silawa soils are on slight ridges and have a thinner surface layer than the Silstid soil. Included soils make up less than about 15 percent of any one mapped area.

This Silstid soil is used mainly for pasture of common and improved bermudagrass. The potential for pasture is medium.

Potential for crops is low. Yields are reduced because the thick sandy surface layer is droughty. Crop residues left on the soil surface reduce soil blowing and conserve moisture.

Potential for rangeland is medium. Good stands of native grasses can be maintained through proper stocking and controlled grazing.

Potential for most recreational use is medium. The major limitation is soil blowing, which can be overcome by maintaining a good grass cover on recreational areas.

This soil is in capability subclass IIIe; Sandy range site.

73—Silstid-Urban land complex, 1 to 5 percent slopes. This gently sloping complex is on convex ridges. Soil areas have a smooth surface and are subrounded. They range from 20 to about 70 acres.

Silstid soils make up 40 to 60 percent of the unit, Urban land 20 to 40 percent, and included soils less than 30 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

Typically, the surface layer of Silstid soils is neutral, brown loamy fine sand about 6 inches thick. From 6 to 30 inches is slightly acid, very pale brown loamy fine sand. From 30 to 72 inches is medium acid, brownish yellow sandy clay loam with brownish, grayish, and red-

dish mottles. From 72 to 80 inches is slightly acid, mottled red, light gray, and brownish yellow loamy sand.

Silstid soils are well drained. Runoff is slow, and permeability is moderate. Available water capacity is medium. The droughtiness of the thick sandy surface layer is a consideration when selecting plants for landscaping. Plants require frequent watering.

Urban land is covered by individual dwellings and adjoining streets, driveways, sidewalks, and patios. In some areas part of the surface layer has been removed and refilled with loamy soil material. More sloping areas have been partially leveled, resulting in a variable thickness of the surface layer.

Included with this complex in mapping are mainly areas of Gasil and Konsil soils in the lower areas, and Silawa soils on the higher ridges.

Potential for recreational use is medium because of the sandy surface.

This complex is not placed in a capability subclass or range site.

74—Slidell clay, 1 to 3 percent slopes. This deep, gently sloping soil is in valley fill areas and in the low landscape positions. Soil areas have a smooth surface and are mainly elongated. They range from 10 to about 250 acres. Untilled areas have relief characterized by cycles of microdepressions and microknolls repeated each 10 to 20 feet. Microknolls are 3 to 16 inches higher than microdepressions.

Typically, the surface layer in the center of a microdepression is moderately alkaline, dark gray clay about 6 inches thick. From 6 to 32 inches is moderately alkaline, very dark gray clay. From 32 to 72 inches is moderately alkaline, grayish brown clay with yellowish brown mottles in the lower part. From 72 to 80 inches is moderately alkaline, light brownish gray clay with olive yellow mottles.

This soil is well drained. Surface runoff is slow. Permeability is very slow. Available water capacity is high. This soil receives runoff water from the higher slopes, and it is difficult to work during extremes in the moisture content.

Included in mapping are small areas of Branyon, Burleson, and Sanger soils. Branyon and Burleson soils are on the lower parts of the landscape. Sanger soils are above areas of the Slidell soil on the landscape. Included soils make up less than 20 percent of any one mapped area.

This Slidell soil is used as pasture, cropland, and rangeland. Potential for crops and pasture is high. Main pasture grasses are common and improved bermudagrass.

Cropland management needs include terracing, contour farming, and crop residue management. Crop residues left on the soil surface conserve moisture and improve soil tilth.

Potential for rangeland is high. The management needed to maintain good stands of grass includes proper stocking and controlled grazing. Brush management is needed in some areas where mesquite trees are increasing in density.

Potential for recreational use of this soil is low. Very slow permeability and clayey texture are the main limitations.

This soil is in capability subclass IIe; Blackland range site.

75—Somervell gravelly loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on high convex ridges and side slopes. Soil areas are mainly longer than they are wide and range from 10 to 80 acres.

Typically, the surface layer is about 5 inches of moderately alkaline, dark grayish brown gravelly loam. Between the depths of 5 and 15 inches is moderately alkaline, dark grayish brown very gravelly loam that is about 60 percent limestone gravel and cobbles. From 15 to 27 inches is moderately alkaline, light yellowish brown very gravelly clay loam that is about 45 percent limestone gravel and cobbles. Below 27 inches is hard, fractured limestone rock with light yellowish brown, light gray, and yellow limy earth in fractures.

This soil is well drained. Runoff is rapid. Permeability is moderate. Available water capacity is very low. The hazard of erosion is severe where the soil is left bare. The limited rooting depth and available water capacity need to be considered when selecting plants for this soil.

Included in mapping are small areas of Aledo and Bolar soils. The shallow Aledo soils are on the higher ridges and narrow limestone benches on side slopes. Nongravelly Bolar soils are mainly in the lower areas. Included soils make up less than 30 percent of any one mapped area.

This Somervell soil is used mainly as rangeland. Some small areas within larger fields of deeper soils are planted to small grain. Potential for cropland is low because of low available water capacity.

Potential for pasture is low. Common and improved bermudagrass can be grown on this soil.

This soil has medium potential for rangeland. Limiting the grazing will help maintain the stand of grass.

Potential for recreational development is medium. Small stones are the major limitation.

This soil is in capability subclass VIs; Clay Loam range site.

76—Speck clay loam, 1 to 3 percent slopes. This shallow, gently sloping soil is on convex ridges. Soil areas have a smooth surface and are longer than they are wide. They range from 5 to 40 acres.

Typically, the surface layer is neutral, brown clay loam about 7 inches thick. From 7 to 15 inches is mildly

alkaline, dark reddish brown clay. From 15 to 18 inches is fractured, very hard limestone rock.

This soil is well drained. Surface runoff is medium. Permeability is slow. Available water capacity is very low. The hazard of erosion is severe. Productivity is reduced by the limited moisture and rooting depth.

Included in mapping are small areas of Somervell soils on the outer edges of mapped areas. Included soils make up less than about 15 percent of any one mapped area.

This Speck soil is used mainly as rangeland. A few areas within fields of deeper soils are planted to small grain. Potential for rangeland is low. Proper stocking and controlled grazing are needed to maintain good stands of grass.

Potential for pasture is low. The shallow rooting depth and very low available water capacity reduce plant growth.

Cropland potential for small grain is low. This soil is better suited to crops that grow during cool, wet seasons than to summer crops. Crop residues left on the soil surface conserve moisture and reduce erosion.

Potential is medium for most recreational use because this soil has clay loam texture and slow permeability.

This soil is in capability subclass IIIe; Redland range site.

77—Stephen silty clay, 1 to 5 percent slopes. This shallow, gently sloping soil is on convex ridges and side slopes. Soil areas are rounded and range from 10 to 100 acres.

Typically, the surface layer of this soil is moderately alkaline, brown silty clay about 8 inches thick. From 8 to 14 inches is moderately alkaline, brown very gravelly silty clay that is about 80 percent chalk fragments. Below a depth of 14 inches is white platy chalk.

This soil is well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is very low. The hazard of erosion is severe. Productivity is reduced by the limited rooting depth.

Included in mapping are small areas of Eddy soils. Eddy soils are on the slightly higher ridges. Some soils are included that are similar to the Stephen soil but slightly deeper. Included soils make up less than 20 percent of any mapped area.

This Stephen soil is used mainly as pasture and rangeland. Some fields are planted to small grain. Potential for pasture and rangeland is low.

Potential for crops is low. Terraces are difficult to construct in this thin soil. Crop residues left on the soil surface reduce erosion and conserve moisture. This soil is suited to cool-season crops that grow during periods of high rainfall.

Potential for recreational development of this soil is medium because it is shallow to rock and has a clayey texture. A good stand of grass is needed to reduce erosion in areas of heavy use.

This soil is in capability subclass IVe; Chalky Ridge range site.

78—Trinity clay, occasionally flooded. This deep, nearly level soil is on low flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from 8 to 250 acres. This soil is subject to flooding for short periods about once each 5 to 10 years.

Typically, this soil is moderately alkaline, very dark gray clay about 60 inches thick.

This soil is somewhat poorly drained. Runoff is very slow. Permeability is very slow. Available water capacity is high. Following rains, water ponds on the surface for a few hours. The rooting zone is deep. This soil is difficult to work during extremes in the moisture content.

Included in mapping are small areas of Kaufman and Ovan soils. Kaufman soils are in the slightly lower landscape positions. Ovan soils are in the slightly higher, better drained areas. Included soils make up less than 30 percent of any one mapped area.

This Trinity soil is used for pasture and crops. Pasture potential is high. This soil is suited to common and improved bermudagrass. Some forage sorghum is planted for hay and grazing.

Potential for crops is high. Early planted crops are damaged by water ponding on the soil surface in wet years. Crop residues left on the soil surface conserve moisture and improve soil tilth. Surface drainage is beneficial in some areas.

Rangeland potential is high. Proper stocking, controlled grazing, and brush management are among the management needs.

Potential for most recreational use of the soil is low. Main limitations are clayey texture, hazard of flooding, and very slow permeability.

This soil is in capability subclass IIw; Clayey Bottomland range site.

79—Trinity clay, frequently flooded. This deep, nearly level soil is on low flood plains of major streams. Slopes range from 0 to 1 percent. Soil areas are longer than they are wide and range from 15 to 200 acres. This soil floods one or more times in most years during spring and fall months.

Typically, the surface layer of this soil is moderately alkaline, very dark gray clay about 17 inches thick. From 17 to 60 inches is moderately alkaline, dark gray clay.

This soil is somewhat poorly drained. Permeability is very slow. Available water capacity is high. Runoff is very slow, and water ponds on the soil surface for a few hours following rains. The wetness and hazard of flooding limit the suitability of this soil for plants.

Included in mapping are small areas of Kaufman and Ovan soils. Kaufman soils are on the lower parts of the landscape. Ovan soils are in the slightly higher areas.

Included soils make up less than about 30 percent of any mapped area.

This Trinity soil is used for pasture and wildlife. Potential for pasture is high. This soil is well suited to common and improved bermudagrass. Potential for rangeland is high.

Potential for crops is low. Flooding and wetness are the main limitations. Some areas can be planted to quick maturing forage sorghums following the floods in spring.

Potential of this soil is low for recreational use. Wetness, very slow permeability, the hazard of flooding, and clayey texture are the main limitations.

This soil is in capability subclass Vw; Clayey Bottomland range site.

80—Vertel clay, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on convex foot slopes. Soil areas are longer than they are wide. They follow the contours of the slopes and are dissected by shallow drains. Soil areas range from 10 to 85 acres. Untilled areas are characterized by relief consisting of microdepressions 1 to 3 feet wide and microknolls 10 to 16 feet wide. Microknolls are 2 to 8 inches higher than microdepressions.

Typically, the surface layer is about 18 inches of neutral, dark grayish brown clay. From 18 to 28 inches is mildly alkaline, light yellowish brown clay with reddish mottles. From 28 to 80 inches is moderately alkaline, mottled gray and yellowish brown very shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow. Available water capacity is medium. The hazard of erosion is severe. The dense clay and moderate rooting depth are considerations when selecting plants to be grown on this soil.

Included in mapping are small areas of Heiden soils on the slightly higher landscape positions. Soils that are similar to the Vertel soils but deeper are also included in some areas. Included soils make up less than about 15 percent of any mapped area.

This Vertel soil is used mainly as pasture and rangeland. Some fields are in cropland. Potential for pasture is medium.

Potential for crops is medium. Terracing and contour farming are needed to control erosion. Residues of crops left on the soil surface conserve moisture and reduce runoff.

Rangeland potential is medium. Proper stocking and controlled grazing are among the management needed on this soil. Brush management is needed in some areas.

Potential for recreational development of this soil is low. The clayey texture can be partially overcome by maintaining a good grass cover.

This soil is in capability subclass IIIe; Eroded Blackland range site.

81—Vertel clay, 3 to 5 percent slopes. This moderately deep, gently sloping soil is on side slopes above drains and on gently undulating low ridges that have a smooth appearance. Soil areas are rounded and range from 8 to 200 acres. Untilled areas are characterized by relief consisting of microdepressions 1 to 3 feet wide and microknolls 10 to 16 feet wide. Microknolls are 2 to 8 inches higher than microdepressions.

Typically, the surface layer is neutral, grayish brown clay about 6 inches thick. From 6 to 33 inches is mildly alkaline, grayish brown clay with yellowish brown mottles. From 33 to 66 inches is medium acid, stratified dark gray, yellowish brown, yellow, and yellowish red very shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow. Available water capacity is medium. The hazard of erosion is severe, and erosion is evident in some areas. The limited rooting depth and dense clay need to be considered when selecting plants to be grown on this soil.

Included in mapping are small areas of Ferris and Heiden soils. These soils are mainly on the higher parts of the landscape. Included soils make up less than about 20 percent of any one mapped area.

This Vertel soil is used mainly as rangeland. Production potential is medium. Management needs include proper stocking and controlled grazing.

Potential for crops is low. Terracing and contour farming are needed. Crop residues left on the soil surface reduce erosion and improve tilth. Cover crops are beneficial on this soil.

Potential for pasture is low. This soil is suited to common and improved bermudagrass. Planting should be done on the contour to reduce erosion before the grass is established.

Potential for most recreational use of the soil is low. The clayey texture and very slow permeability are the main limitations.

This soil is in capability subclass IVe; Eroded Blackland range site.

82—Vertel clay, 5 to 12 percent slopes. This moderately deep, sloping to strongly sloping soil is on convex ridges and side slopes. Soil areas are subrounded and range from 15 to about 100 acres. Untilled areas are characterized by relief consisting of microdepressions 1 to 3 feet wide and microknolls 10 to 16 feet wide. Microknolls are 2 to 8 inches higher than microdepressions.

Typically, the surface layer is mildly alkaline, pale olive clay about 12 inches thick. From 12 to 26 inches is moderately alkaline, olive gray clay with olive mottles. From 26 to 60 inches is moderately alkaline, stratified gray and yellowish brown very shaly clay.

This soil is well drained. Permeability is very slow. Available water capacity is medium. Runoff is rapid, and the hazard of erosion is severe. Small eroded spots and

gullies are in some areas. The limited rooting depth and dense clay are factors to be considered when selecting plants to be grown on the soil.

Included in mapping are small areas of Ferris and Heiden soils. These soils are mainly on the higher parts of the landscape near the upper part of the side slope. Included soils make up less than 20 percent of any mapped area.

This Vertel soil has medium potential for rangeland. Proper stocking and controlled grazing are needed to maintain stands of grass. Brush management is needed in some areas.

Potential for pasture is low. This soil is suited to common and improved bermudagrass.

This soil is not suitable for crops because of slope and erodibility.

Potential for recreational development of this soil is low. The slope, very slow permeability, and clayey texture are difficult to overcome.

This soil is in capability subclass VIe; Eroded Blackland range site.

83—Wilson clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on the low part of the landscape along the drainageways and in concave areas. Soil areas have a smooth surface and are mainly elongated. They range from 17 to 100 acres.

Typically, the surface layer is medium acid, very dark gray clay loam. From 6 to 40 inches is neutral, dark gray clay with brownish mottles. From 40 to 54 inches is moderately alkaline, gray clay. From 54 to 60 inches is moderately alkaline, light gray clay with yellowish brown mottles. From 60 to 80 inches is moderately alkaline, strong brown clay with gray mottles.

This soil is somewhat poorly drained. Permeability is very slow. Available water capacity is high. Surface runoff is very slow, and water is ponded on the soil surface for a few hours following rains. Plant growth is reduced during wet seasons.

Included in mapping are small areas of Burleson and Navo soils. Burleson soils are on the slightly lower parts of the landscape. Navo soils are on slight ridges. Included soils make up less than 20 percent of any one mapped area.

This soil is used for crops and pasture. Potential for these uses is medium. Crop residues left on the surface of fields help improve soil tilth. Cover crops are beneficial. Surface drainage may be needed in some areas.

Potential for rangeland is medium. Management needs include proper stocking and controlled grazing.

Potential for most recreational use of this soil is low. Very slow permeability and wetness are the main limitations. Drainage should be provided in most areas.

This soil is in capability subclass IIIw; Claypan Prairie range site.

84—Wilson clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on the low part of the landscape and side slopes. Soil areas are longer than they are wide and range from 10 to about 100 acres.

Typically, the surface layer is slightly acid, gray clay loam about 5 inches thick. From 5 to 34 inches is slightly acid, dark gray clay. From 34 to 43 inches is moderately alkaline, light brownish gray clay. From 43 to 52 inches is moderately alkaline, grayish brown clay. From 52 to 64 inches is moderately alkaline, light brownish gray clay that has yellowish brown mottles.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow. Available water capacity is high. This soil receives runoff from the higher parts of the landscape. Wetness is a hazard during rainy seasons. Plant roots have difficulty penetrating the lower layers of this soil.

Included in mapping are small areas of Burleson and Navo soils. These make up 5 to 15 percent of most areas.

This soil is used for pasture and crops. Potential for pasture is high. This soil is suited to common and improved bermudagrass.

Potential for crops is medium. Crop residues left on the soil surface improve soil tilth and maintain the level of organic matter. Cover crops are beneficial.

Potential for rangeland is medium. Management needs include proper stocking and controlled grazing.

Potential for recreational use of this soil is low. Very slow permeability and wetness are the main limitations. Drainage can be used to remove surface water.

This soil is in capability subclass IIIe; Claypan Prairie range site.

85—Wilson-Urban land complex, 0 to 2 percent slopes. This nearly level to gently sloping complex is in valley fill areas and on the low part of the landscape. Soil areas have a smooth surface and are rounded. They range from 10 to about 35 acres.

Wilson soils make up 50 to 60 percent of the complex, Urban land 20 to 40 percent, and included soils less than 35 percent. The components of this complex are so intricately mixed that separation is not practical at the scale mapped.

The Wilson soil in this complex typically has a slightly acid, very dark gray clay loam surface layer about 5 inches thick. From 5 to 34 inches is slightly acid, dark gray clay. From 34 to 64 inches is moderately alkaline, grayish brown clay with yellowish brown mottles in the lower part.

Urban land is covered by individual dwellings and adjoining streets, driveways, sidewalks, and patios. Some public buildings and their parking lots are included. Some areas have been disturbed by filling so that classification of the original soil is not practical.

Included with this complex in mapping are areas of Burleson and Navo soils.

This complex is not placed in a capability subclass or range site.

Use and management of soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops, pasture, and rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

The general management needed for crops and pasture is described in this section. The crops or pasture plants best suited to the soils including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 183,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total, 71,000 acres was used for row crops; 82,000 acres for close-growing crops, mainly wheat and oats; and 23,000 acres for rotation hay and pasture. The rest was idle cropland.

The soils in Denton County have good potential for increased production of food. About 130,000 acres of potentially good cropland is currently used as pasture, and about 50,000 acres is rangeland. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1975 there was an estimated 150,000 acres of urban and built-up land in the survey area. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major concern on about one-half of the cropland and pasture in Denton County. If slope is more than 1 percent, erosion is a hazard. Burleson, Heiden, Houston Black, and Slidell soils, for example, have slopes of 1 to 3 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Callisburg, Crockett, Navo, and Wilson soils, and to soils that have a layer in or below the subsoil that limits the depth of the root zone such as the Aledo, Birome, Somervell, and Stephen soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils (fig. 9). On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, provide nitrogen, and improve tilth for the following crop.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Most deep soils are suitable for terraces. Moderately deep and shallow soils are less suitable for terracing and diversions because bedrock is at a depth of less than 40 inches.

Figure 9.—Crop residues left on the surface to reduce erosion on Slidell clay, 1 to 3 percent slopes.

Contouring and contour stripcropping are widespread erosion control practices in the survey area. They are best adapted to soils that have smooth, uniform slopes, including most of the sloping soils in the county.

Soil blowing is a hazard on the sandy Aquilla, Silawa, and Silstid soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Information for the design of erosion control practices for each kind of soil is available in local offices of the Soil Conservation Service.

Soil drainage is not a major problem in Denton County, but drainage may be beneficial on the nearly level clayey soils. It is also beneficial in small areas of wetter, low-lying soils that are commonly included in mapped areas of the moderately well drained Branyon, Burleson, Crockett, and Houston Black soils, especially where slopes are 0 to 1 percent.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during some years. In this category are the occasionally flooded Trinity soils and the Wilson soils. These soils make up about 28,120 acres.

Soil fertility is naturally low in most soils on uplands in the survey area. The soils on flood plains range from slightly acid through moderately alkaline and are naturally higher in plant nutrients than most soils on uplands.

Some sandy and loamy soils on uplands are acid in their natural state. If cropland has never been limed, applications of ground limestone may be beneficial. Available phosphorus and potash levels are naturally low in most of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops are clayey, and tilth is a concern because the soils often stay wet until late in spring. If they are wet when plowed, they tend to be very

cloddy when dry and good seedbeds are difficult to prepare. Fall plowing on such wet soils generally results in good tilth in the spring. Additions of organic matter will improve soil structure and tilth.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Grain sorghum, cotton, and soybeans are the main row crops (fig. 10). Peanuts are grown on some of the loamy and sandy soils.

Wheat and oats are the common close-growing crops. Other small grains can be grown, and grass seed can be produced.

Special crops grown commercially in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage is used for melons, sweet corn, tomatoes, and other vegetables and small fruits. In addition, large areas can be adapted to other special crops such as grapes. Apples and peaches are the most important tree fruits grown in the survey area. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many nut trees, vegetables, and small fruits.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

Figure 10.—Soybeans ready for harvest on Justin fine sandy loam, 0 to 1 percent slopes.

appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 5. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Rangeland

About 18 percent of Denton County is range. About half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are dominant.

On many ranches the forage produced on rangeland is supplemented by crop stubble and small grain. In winter the native forage is often supplemented by protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural

plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community (fig. 11). Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year those conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and

Figure 11.—Good range grass on Clay Loam range site. Soil is Somervell gravelly loam, 1 to 5 percent slopes.

on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are re-established. Controlling brush and minimizing soil blowing are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some light vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the inten-

sity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be established, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants.

Engineering

James Pohl, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were

made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through

subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper tranches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill, topsoil, sand, and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil

after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment.

Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Town and country planning

In Denton County, both rapid population growth and increased mobility have placed more people in situations where soil conditions directly affect them. This is especially true in rural-urban fringe areas to which people are moving in order to enjoy some of the amenities of country living. Many of these people need soils information for tracts that are well beyond public utilities, especially owners of summer homes and recreational facilities.

Residential subdivision development and the accompanying extension of public utilities create a need for soils information that is somewhat different from the information needed for farming. Land appraisers, realtors, city planners, builders, and home owners need to know which sites are suitable for homes or other buildings and which should be reserved for other uses. This depends largely on the properties of the soil at each site. These soil properties are described in the sections "Engineering properties" and "Physical and chemical properties," that include tables and explanations of soil interpretations and properties. Information in the engineering sections does not eliminate the need for more detailed onsite studies when soils are used intensively. Some lots have inclusions of contrasting soils that are too small to show separately on the soil map.

This section briefly discusses the importance of site selection. It then considers use of the soils for foundations and sewage disposal systems, the control of erosion and runoff, and the potential of the soils for urbanization. It also has a brief section on gardening and landscaping.

Site selection

In selecting a site for the construction of urban works and structures, the soil should be carefully investigated. Costly failures have been traced to mistakes made in selecting soils for proposed structures or to lack of information about the soils that were used. If the soil is poorly suited to the intended use, there is little that can be done without great expense to change it. In some instances, the structure can be designed to combat the limitations of the soil, but the problem must be known prior to construction.

One of the first considerations is whether the soil is subject to flooding. The alluvial Bunyan, Energy, Frio, Gowen, Kaufman, Ovan, Seagoville, and Trinity soils are subject to occasional or frequent flooding and should not be considered as sites for permanent structures. Areas of these soils should be reserved for green belts, sound barriers, wildlife habitat, and recreational uses, such as hike and bike trails or picnic areas.

These alluvial soils are not within the intermediate regional flood plain as designated by the U.S. Army Corps of Engineers. The alluvial soils were formed by deposition of sediments by streams. The intermediate

regional flood plain was caused by runoff as a result of intensive urban construction within the watershed. Flood plain information on major streams in the county is available from the Denton Soil and Water Conservation District. Additional information on flood prone areas is available from the U.S. Geological Survey.

Other soil properties that affect site selection are permeability, available water capacity, drainage, soil reaction (pH), shrink-swell potential, corrosivity to steel and concrete, and hydrologic classification. Also important are the suitability of the soil as a septic tank absorption field or site for foundations and low cost streets and roads; erosion and runoff problems; potential for recreational use; suitability for growing grasses, flowers, vines, shrubs, and trees; and influence of the soil on the overall general health of residents. Many of these soil properties, features, and interpretations are given in the sections on engineering and recreation. Some of the more important ones are discussed in the following paragraphs.

Foundations

The soils of Denton County require special attention when considered as sites for foundations. In some parts of the county clay soils, which are high in the clay mineral montmorillonite, swell when wet and shrink and crack when dry. This creates such pressure that walls and foundations will crack unless, and sometimes even if, specially reinforced. This change in volume of a soil as moisture content changes is called shrink-swell potential. Some soils that have only the lower layers high in montmorillonite also need special consideration.

Soils likely to swell and shrink enough to damage foundations are those that have a high liquid limit and high plasticity index, or those soils classified as CH in the Unified System of Classification. See table 15 for estimated engineering properties and classifications, and table 17 for engineering test data. In addition, see table 9 where soils are rated for building site development.

Other characteristics that merit special attention in soils that are considered for foundations are flooding, low strength, or high corrosivity.

Sewage disposal systems

Many new houses are built annually beyond existing municipal sewerlines and are serviced by septic tank absorption fields. The effectiveness of these systems depends largely on the absorptive capacity, permeability, percolation rate, wetness, flooding, seepage, and slope of the soils within the filter field.

The soils of Denton County, in general, are severely limited as sites for septic tank absorption fields. Several areas of the county consist of clay soils, which are very slowly permeable.

In table 10 the soils are rated for sanitary facilities. By using the soil map to identify the soils and then referring to the ratings in table 10, it is possible to get a general idea of how well septic tanks would function in a selected area. Nevertheless, it is advisable to make a detailed inspection of the soils at the exact site that is to be used as a filter field.

Control of erosion and runoff

During urban construction the natural vegetation is generally removed and large areas are covered with pavement, concrete, and buildings. The amount of runoff generally increases with construction, and the pattern of runoff changes. Runoff after a heavy rain may be several times as great from construction areas as when the same land was used for farming. The runoff concentrates in streets and gutters instead of flowing into natural waterways, and the result is flooding, erosion, and deposition of sediments in lower areas. See table 12 for limitations and features affecting water management.

The control of erosion and runoff should begin at the planning and design stage, before plans become fixed and construction begins. With a good development plan, the problems brought on by soil erosion, runoff, and sedimentation can usually be avoided or reduced.

The two methods of erosion and sediment control are mechanical and vegetative.

Some of the mechanical measures used to reshape the land to intercept, divert, convey, retard, or otherwise control erosion and runoff follow.

Land grading.—Applies only to those areas going into immediate construction, as opposed to grading the entire site. Avoid leaving a large area bare and unprotected by vegetation.

Bench terraces.—Should be constructed across the slope of the land and fit the natural terrain. By breaking up long slopes, bench terraces slow the flow of runoff.

Subsurface drains.—If it is necessary to fill natural drainage channels, the installation of subsurface drains will help remove excess ground water.

Diversions.—Channels and ridges constructed across the slope to intercept and divert runoff so that it will not cause damage. Diversions need a stable outlet to dispose of water safely.

Berms.—A type of diversion. Berms are compacted earth ridges on a slight grade and have no channels. They may be temporary or permanent.

Storm sewers.—A good way to dispose of runoff from the streets and adjacent lots. In order to prevent sediments from being deposited downstream, however, or even clogging the storm sewers, small temporary or permanent sediment basins should be constructed adjacent to sewer inlets.

Outlets.—These are generally grassed waterways. Outlets are constructed to dispose of water safely from diversions, parking lots, streets, and other areas.

Waterway stabilization structures.—To prevent erosion from runoff on slopes too steep to be vegetated, grade

stabilization structures, special culverts, and different kinds of pipe can be used, generally in combination with vegetation.

Lined channels.—Where slopes are too steep or soils too unstable for control by vegetation alone, plastic or fiberglass mats can be used as temporary lining for ditches and channels.

Sediment basins.—Temporary earth dams constructed across waterways to detain runoff and trap sediment and prevent damage to areas downstream.

Some of the vegetative measures used to control erosion and runoff during and after construction are mulching and holding mulch in place with fibrous material, and the planting of temporary or permanent ground cover.

Mulches.—Small grain straw, hay, and certain processed materials can be used to protect slopes and other critical areas brought to final grade at an unfavorable time for seeding. The areas can then be seeded when the time is favorable without removing the mulch. Mulches need to be anchored with asphalt, by straight blade disking or netting, or other methods. Hydromulching, in which seed, fertilizer, and mulch are applied as a slurry, is a fast, all-in-one operation that requires little labor.

Temporary cover.—Rapidly growing plants, such as annual rye grass and small grain can be used where cover is needed for a few months or a year or two.

Permanent cover.—Bermudagrass, bahiagrass, weeping lovegrass, and adapted legumes, trees, shrubs, and certain vines make good permanent ground cover. Most grasses and legumes require maintenance, such as weeding, fertilizing, and mowing.

Fibrous materials.—Jute netting, cotton netting, paper netting, and fibergrass matting are used to control erosion and runoff. Most of these fibrous materials are used only temporarily to hold mulches in place or to prevent soil from blowing or washing while plant seedlings are getting established.

In many areas the overall development plan does not include the control of erosion and runoff. Erosion control is left to the individual homeowner. Some of the erosion-control measures that are practical for protection of small residential tracts follow.

Grading.—Grade the surface of the lot to make it level or gently sloping. In areas where soils have a loamy surface layer, it is beneficial to remove and stockpile the topsoil so that it can later be replaced on the graded surface.

Contouring.—Place driveways, walks, fences, retaining walls, and raised flower beds on the contour, or if that is not feasible, put them straight across the slope.

Diversions.—Build small diversions that will intercept runoff and keep it from flowing across erodible areas. The diversions should be protected with permanent vegetation.

Waterways.—Construct waterways to help prevent gullying and help drain areas where water stands. Waterways need to be shaped, smoothed, and sodded. In some cases waterways may be small ditches along property lines between lots. They generally empty into bar ditches or paved and curbed streets.

Drainage.—Drain seep spots, waterlogged areas, and small ponded areas. This can generally be done with ditches or tile drains. Some low areas can be filled with good topsoil.

Special care should be taken in planning and applying erosion-control and runoff-control measures. They should be designed to fit the landscape.

Potential for urbanization

The potential of a soil for urbanization is its ability to support a given structure or activity relative to the cost expressed in economic, social, or environmental terms.

The soils of Denton County have been rated in table 13 for their potential for urbanization. The elements considered are: (1) dwellings without basements, but with public sewer systems, (2) streets, (3) excavations in which to place utilities, and (4) uncoated steel pipe. Potential for shopping centers and small businesses was also considered in the rating.

The soils that have the highest potential for urbanization are those on which streets and structural foundations can be placed and not deteriorate because of adverse soil factors. In general, these soils are easy to dig and easy to grow plants in. They are well drained and do not flood and the landscape is pleasing to the eye. The factors to consider in rating a soil's potential for each element of urbanization are flooding, high water table, wetness, shrink-swell potential, soil strength, soil texture, and corrosivity to uncoated steel.

Soils that are flooded have very low potential for urbanization because of the difficulty and expense involved in control of floodwaters. In most cases, the watershed includes an area much larger than that over which any single land developer has control.

Soils that are wet or have a high water table are not dominant in Denton County. These characteristics are most often associated with flood plain soils. Soils that are or have a high water table have medium or low potential for urbanization. Drainage systems can be installed on these soils, however, to alleviate the problem.

Soils that have a high shrink-swell potential and low strength have low potential for urbanization. These limitations can be partially overcome by increasing the strength of the structures. In Denton County, these soils often have additional limitations, such as clay texture and high corrosivity to uncoated steel, that further lower their potential for urbanization.

Clay soils are difficult to excavate and to move or manipulate. This adds to the cost of development and maintenance.

Soils that are highly corrosive to uncoated steel pipes generally have other limiting factors. The corrosive effect

of the soil on uncoated pipes can be partially overcome by using protective coatings, or by attaching anodes to the metal, or by using more resistant metals or materials such as plastics or concrete.

In table 9, the limitation of a soil for building site development may be based on the rating of a single factor. For example, a soil that shrinks and swells is rated as severely limited for buildings because of that one factor. In table 13, the rating factors are cumulative. That is, a soil that is clayey and is highly corrosive to metals is rated lower than a soil that has low strength. Further, the cumulative ratings of elements of urbanization—dwellings, streets, excavations, and uncoated steel pipe—are used to rate the overall potential of the soil for urbanization.

The potential of soils for urbanization can be high, medium, low, and very low.

High—soils with a few limitations that will cause problems during construction or after development. The limitations can be economically overcome.

Medium—soils with several limitations that will cause problems during construction or after development. Some can be easily overcome, but one or more limitations will be difficult or expensive to overcome.

Low—soils with several limitations that will cause problems, both during construction and after development. They can only be overcome with difficulty and very expensive measures.

Very low—soils that flood and may have other problems. Limitations are impractical and very expensive to overcome.

Gardening and landscaping

Suburban homeowners who want to landscape their homes need to know what soils their properties include and to what flowers and ground cover, vines, shrubs, and trees these soils are best suited. In some areas plants may be needed for erosion control as well as esthetic purposes.

Soils well suited for yard and garden plants are those that have a deep root zone, a loamy texture, a balanced supply of plant nutrients, and plenty of organic matter in various stages of decomposition. They also have adequate water supplying capacity, good drainage, and a granular structure that allows for free movement of water, air, and roots. The degree of acidity or alkalinity of the soil suitable for growing particular plants is also important. For example, roses and most annual flowers, most vegetables, and most grasses grow best in soils that are neutral (noncalcareous) or only slightly acid. Azaleas, camellias, and similar plants need acid soils. Some plants grown on soils high in lime, such as the Bolar soils, develop a condition called chlorosis, or yellowing of the leaves. However, many flowers, shrubs, and trees are well suited to the limy (calcareous) soils in Denton County. Some of these flowers are Shasta daisies, hollyhocks, petunias, zinnias, and gladiolus. Crapemyrtle, dogwood, pecan, and fruitless mulberry are some of the shrubs and trees.

See soil descriptions in the section "Soil maps for detailed planning" for information on soil texture, drainage, permeability, structure, and other characteristics. Table 14 shows soil reaction (pH), permeability, and available water capacity of the soils.

It is generally less expensive to condition the native soil than to replace it with a manmade soil material. The soil should be tested and fertility needs determined for the plants that are to be grown. The most important amendment to the soil is organic matter. This may be leaves, peat moss, compost, rotted sawdust, or manure. At least 2 inches of organic matter should be added to the soil. For clayey soils, also add at least 2 inches of sand, perlite, or vermiculite. In addition, broadcast 5 pounds of superphosphate (0-20-0) and 10 pounds of gypsum per 100 square feet. All of these materials should then be spaded or rototilled into the top 8 inches of the native soil. If an acid soil is desired, also incorporate 1 to 2 pounds of sulfur. If soil is too strongly acid, it may be neutralized by adding bonemeal, lime, wood ashes, or limestone sand.

In some areas of the county, the soils are so clayey it may be necessary to construct raised beds in order to grow flowers and some shrubs. Brick, tile, metal, cedar, or redwood makes good retainers along the edge of beds. Beds should be filled with good soil material that has well balanced physical and chemical amendments.

All plants, whether grown in native soil or manmade soil, require careful maintenance, especially while they are establishing roots. Good management includes fetilizing, watering, weed control, and insect control.

Gardening and landscaping should be included in the basic planning of urban development. The potential of the native soil for growing plants should be considered when selecting sites for urban construction. Also important is the protection of existing trees during construction. In timbered areas, large healthy trees are a valuable and often irreplaceable asset to the property. Some ornamental trees are killed or damaged beyond restoration during excavation, filling, and construction. For guidelines on the protection of existing trees or selection of adapted plants, consult the Soil Conservation Service or Agricultural Extension Service.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are fol-

lowed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering properties and classifications

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The

capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water (*5*).

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams or with runoff from adjacent slopes. Water standing for short periods after rains or after snow melts is not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

Table 17 contains the results of engineering tests performed by the State Department of Highways and Public Transportation and the Soil Conservation Service on some of the soils in Denton County. The table shows the specific location where samples were taken, the depth to which sampling was done, and the results of tests to determine particle size distribution and other properties significant in soil engineering.

As moisture is removed, the soil shrinks and decreases in volume in direct proportion to the loss in moisture until a condition of equilibrium called the shrinkage limit is reached. At this point, shrinkage stops, although additional moisture is removed. Shrinkage limit is reported as the percentage of moisture in ovendry soil.

Lineal shrinkage is the decrease in one dimension of the soil mass that occurs when the moisture content is reduced from the liquid limit to the shrinkage limit. It is expressed as a percentage of the original dimension.

Shrinkage ratio is the volume change that results from the drying of soil material divided by the moisture loss caused by drying. It is expressed numerically.

Mechanical analysis shows the percentage, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass the No. 200 sieve, as do the finer silt and clay particles.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from solid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order

is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustolls (*Calc*, meaning limy horizons, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, thermic Typic Calciustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. The Lewisville series is a fine-silty, mixed, thermic Typic Calciustolls.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Aledo series

The Aledo series consists of very shallow to shallow, loamy, soils on uplands. These soils formed in limestone and marl. Slopes range from 1 to 8 percent.

Typical pedon of Aledo clay loam, in an area of Aledo association, undulating; from the intersection of Farm Road 2450 and Farm Road 455 in Bolivar, 6.0 miles west on Farm Road 455, 3.4 miles north and 0.4 mile east on county road, and 1,000 feet north in rangeland:

A11—0 to 4 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many medium roots; about 8 percent limestone fragments less than 1/2 inch across; calcareous; moderately alkaline; clear wavy boundary.

A12—4 to 9 inches; brown (7.5YR 4/2) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; about 65 percent flat limestone fragments 1/2 inch to 4 inches across the long axis; calcareous; moderately alkaline; abrupt wavy boundary.

R—9 to 15 inches; indurated, coarsely fractured, thin-bedded limestone.

The solum ranges from 8 to 18 inches thick.

The A11 horizon is grayish brown, brown, dark grayish brown, or dark brown. Texture is clay loam, loam, gravelly clay loam, or gravelly loam. Limestone fragments range from 5 to about 35 percent, by volume. The A12 horizon is grayish brown, brown, dark grayish brown, dark brown, or very dark grayish brown. Texture is gravelly clay loam, gravelly loam, very gravelly clay loam, or very gravelly loam. Limestone fragments range from 50 to 80 percent, by volume.

Altoga series

The Altoga series consists of deep, clayey soils on old, high terraces. These soils formed in calcareous clayey sediments. Slopes range from 3 to 12 percent.

Typical pedon of Altoga silty clay, 3 to 5 percent slopes; from the intersection of Farm Road 720 and Cottonwood Park Road in Little Elm, 1.0 mile south on

Cottonwood Park Road and 1,000 feet west into parkland:

A1—0 to 6 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, friable; common roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B2—6 to 23 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; moderate medium blocky and subangular blocky structure; hard, friable; few roots; few films and threads of calcium carbonate on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—23 to 56 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak coarse blocky; hard, friable; about 5 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—56 to 80 inches; brownish yellow (10YR 6/6) silty clay, yellowish brown (10YR 5/6) moist; few fine distinct light brownish gray mottles; massive; hard, firm; about 2 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 37 to 65 inches thick. Depth to soft masses of calcium carbonate is 17 to 28 inches. Texture of the solum is silty clay, silty clay loam, or clay loam.

The A horizon is grayish brown, brown, yellowish brown, pale brown, or light yellowish brown.

The B horizon is brown, yellowish brown, light yellowish brown, very pale brown, yellow, or brownish yellow. A few brownish gray or brown mottles may be below depths of 40 inches. Calcium carbonate as weakly cemented concretions, films, and threads, or soft masses range from 5 to 10 percent.

The C horizon is brownish yellow, yellow, or very pale brown.

Aquilla series

The Aquilla series consists of deep, sandy soils that formed in sandy sediments on old terraces. Slopes range from 2 to 5 percent.

Typical pedon of Aquilla loamy fine sand, 2 to 5 percent slopes; from the intersection of Interstate Highway 35E and Texas Highway 121 in Lewisville, 1.0 mile east on Texas Highway 121, 2.3 miles south on county road, and 100 feet east into pasture:

A1—0 to 13 inches; brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; weak granular structure; loose, very friable; few medium roots; mildly alkaline; gradual smooth boundary.

A2—13 to 56 inches; reddish yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) moist; weak granular structure; loose, very friable; mildly alkaline; diffuse boundary.

A2&B2t—56 to 80 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; with about 20 percent yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) sandy loam lamellae 1/8 to 3/4 inch thick; weak fine subangular blocky structure in the lamellae and single grained between the lamellae; very friable; mildly alkaline.

The solum ranges from 60 to more than 100 inches thick.

The A1 horizon is pale brown, light brown, brown, grayish brown, or yellowish brown. Reaction is neutral or mildly alkaline. The A2 horizon is yellowish brown, light brown, or reddish yellow. Texture is fine sand or loamy fine sand. Reaction is neutral or mildly alkaline. The A2 part of the A2&B2t horizon is brown, light brown, reddish brown, or pink. The B2t part is brown, strong brown, or yellowish red. Texture is fine sandy loam or sandy clay loam. The B2t part is 10 to 30 percent of the horizon and is made up of mottles and lamellae. Reaction is neutral or mildly alkaline.

Aubrey series

The Aubrey series consists of moderately deep, loamy soils that formed in acid clayey shale. Slopes range from 2 to 15 percent.

Typical pedon of Aubrey fine sandy loam, 2 to 5 percent slopes; from the intersection of U.S. Highway 377 and Farm Road 428 in Aubrey, 5.0 miles east on Farm Road 428, 1.7 miles south on Farm Road 2931, and 250 feet east into wooded pasture:

A1—0 to 6 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; very hard, friable; common fine and medium roots; few fine pores; medium acid; clear smooth boundary.

B21t—6 to 20 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, very firm; few fine and medium roots; few clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—20 to 27 inches; red (2.5YR 4/6) and gray (5YR 5/1) clay; moderate medium blocky structure; very hard, very firm; few fine roots; few clay films on faces of peds; common light gray (5YR 7/1) shale fragments; very strongly acid; clear wavy boundary.

Cr—27 to 66 inches; light gray (5YR 7/1) clayey shale, gray (5YR 6/1) moist; common thin strata of strong brown (7.5YR 5/6); massive; extremely hard, very firm; very strongly acid.

The solum ranges from 23 to 40 inches thick.

The A horizon is dark brown or brown. Reaction ranges from medium acid through neutral. A thin A2 horizon slightly lighter in color than the A1 is in some pedons.

The B2t horizon is red, yellowish red, reddish brown, or brown. Contrasting mottles of red, yellowish red, brown, strong brown, gray, or grayish brown range from none to few in the upper part and few to common in the lower part. Texture is 40 to 60 percent clay. Reaction ranges from extremely acid through medium acid.

The Cr horizon is stratified and mottled in shades of red, brown, gray, and yellow. It is clayey shale or shale. Reaction is extremely acid through neutral.

Bastrop series

The Bastrop series consists of deep, loamy soils that formed in loamy sediments on stream terraces. Slopes range from 1 to 5 percent.

Typical pedon of Bastrop fine sandy loam, 1 to 3 percent slopes; from the intersection of Interstate Highway 35 and Farm Road 455 in Sanger, 4.0 miles west on Farm Road 455 to Bolivar, 1.2 miles north on Farm Road 2450, 0.4 mile west, 0.2 mile south, and 0.2 mile east on private road, and 100 feet south in pasture:

Ap—0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak coarse blocky structure; hard, friable; many roots; few worm holes; neutral; aburpt smooth boundary.

B21t—5 to 16 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse prismatic structure parting to weak subangular blocky; hard, firm; few roots; few worm holes; neutral; gradual smooth boundary.

B22t—16 to 56 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm; common clay films; few roots; few worm holes; neutral; gradual smooth boundary.

B23t—56 to 80 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm; few clay films; few fine distinct dark brown mottles; neutral.

The solum ranges from 61 to more than 80 inches thick. Calcium carbonate films, threads, or concretions are below a depth of 70 inches.

The A horizon is grayish brown, brown, pale brown, or light brown. Reaction is slightly acid or neutral.

The B2t horizon is red, reddish yellow, yellowish red, reddish brown, brown, or strong brown. Mottles in shades of red or brown range from none to common. Texture is sandy clay loam or clay loam. Reaction is slightly acid or neutral.

The C horizon, where present, is reddish yellow or light brown. Lenses of pale brown or white fine sand are few to common. Texture is sandy clay loam or fine sandy loam. Strata of gravelly clay loam and loamy sand range from none to common. Reaction is slightly acid through mildly alkaline.

Birome series

The Birome series consists of moderately deep, loamy soils that formed in clayey and loamy sediments high in iron. Slopes range from 1 to 15 percent.

Typical pedon of Birome fine sandy loam, 3 to 5 percent slopes; from the intersection of Loop 288 and U.S. Highway 380 on east side of Denton, 8.0 miles east on U.S. Highway 380, 2.4 miles south on paved county road, 0.9 mile west on unpaved county road, and 50 feet north of right-of-way in wooded pasture:

A1—0 to 6 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable; common roots; common pores; common ironstone and sandstone nodules and fragments less than 1/2 inch across; neutral; clear smooth boundary.

B21t—6 to 17 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium subangular blocky and blocky structure; very hard, firm; few fine roots; few clay films; common flat ironstone fragments less than 1/2 inch in length; medium acid; gradual smooth boundary.

B22t—17 to 27 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; common medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium blocky and subangular blocky structure; hard, firm; few fine roots on ped surfaces; common distinct clay films; common ironstone and sandstone fragments less than 1/2 inch in length; medium acid; gradual smooth boundary.

B3—27 to 34 inches; mottled yellowish red (5YR 5/6), strong brown (7.5YR 5/6), and red (2.5YR 5/6) sandy clay; moderate fine and medium subangular blocky structure; hard, firm; few brittle sandstone fragments 1/2 to 1 1/2 inches across; few ironstone fragments; medium acid; abrupt wavy boundary.

Cr—34 to 60 inches; strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) brittle fractured sandstone with 1 to 4 inch strata of strong brown, yellowish red, red, and gray shaly clay; sandstone in bands 2 to 6 inches thick; very strongly acid in shaly clay, medium acid in sandstone.

The solum ranges from 30 to 37 inches thick. In stony phases, sandstone and ironstone fragments and nodules make up 3 to 15 percent of the volume and range from

less than an inch to 15 inches across, with 2 to 15 percent of the volume fragments coarser than 3 inches across.

The A horizon is pale brown, brown, or light reddish brown. In some pedons, an A2 horizon, 1 to 4 inches in thickness, is slightly lighter in color. Reaction is medium acid through neutral.

The B2t horizon is reddish yellow, yellowish red, reddish brown, light red, or red. It has few to common distinct mottles of reddish yellow, pale brown, strong brown, or dark red in the lower part. The B2t horizon is sandy clay or clay. Reaction is strongly acid or medium acid. The B3 horizon is reddish yellow, strong brown, yellowish red, or red. It is mottled with these colors or has common mottles of strong brown, brown, or yellowish brown. It is clay, sandy clay, or clay loam. Reaction is strongly acid or medium acid.

The Cr horizon is brownish sandstone strata that are 1 to 12 inches thick interbedded with gray, brown, or red shaly clay or sandy clay. Reaction is very strongly acid through medium acid.

Bolar series

The Bolar series consists of moderately deep, loamy soils on uplands. They formed in interbedded limestone and marl. Slopes range from 1 to 5 percent.

Typical pedon of Bolar clay loam, 3 to 5 percent slopes; from the intersection of Interstate Highway 35 and Farm Road 455 in Sanger, 2.0 miles west on Farm Road 455, 0.6 mile north on county road, and 1,100 feet east into rangeland:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable; common roots; common worm casts; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B21—13 to 20 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium blocky structure; slightly hard, very friable; few fine roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

B22ca—20 to 31 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; about 5 percent soft masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—31 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine faint light yellowish brown and brown mottles; weak fine subangular blocky structure; slightly hard, very friable; about 15 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

R—36 to 44 inches; hard, fractured limestone rock coated with soft calcium carbonate; fractures filled with light brownish gray (2.5Y 6/2) and pale yellow (2.5Y 7/4) marly clay.

The solum ranges from 27 to 39 inches thick.

The A horizon is brown, dark grayish brown, or dark brown. Texture is loam, clay loam, or silty clay loam.

The B horizon is brown, pale brown, grayish brown, light brownish gray, or light olive brown. Mottles of yellowish brown or brown range from none to common in the lower part. Texture is clay loam or silty clay loam. Visible calcium carbonate ranges from 5 to 20 percent by volume soft bodies and concretions.

The R horizon is coarsely fractured limestone that is interbedded with brownish, grayish, or yellowish marly clay or silty clay.

Branyon series

The Branyon series consists of deep, clayey soils on uplands. They formed in filled valleys or ancient terraces of calcareous, clayey sediments. Slopes range from 0 to 3 percent.

Typical profile of Branyon clay, 0 to 1 percent slopes; from the intersection of Farm Road 720 and Farm Road 423 in Little Elm, 2.0 miles south on Farm Road 423, 2.7 miles west on paved county road to entrance to Hackberry Park, and 150 feet southeast into park:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few fine calcium carbonate concretions; many vertical cracks less than 1/2 inch long; calcareous; moderately alkaline; clear wavy boundary.

A1—6 to 56 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few fine calcium carbonate concretions; common fine and coarse intersecting slickensides at a depth of more than 20 inches, tilted 45 to 70 degrees from horizontal; calcareous; moderately alkaline; diffuse boundary.

AC—56 to 80 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine distinct yellowish brown mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; common calcium carbonate concretions 1 to 2 mm in diameter; few fine slickensides, calcareous; moderately alkaline.

The solum is more than 80 inches thick. Depth to subhorizons having chroma of more than 1.5 is 50 to more than 80 inches.

The A horizon is dark gray or very dark gray. It is 22 to 60 inches in more than 80 percent of each pedon. The AC horizon is gray or grayish brown. Mottles of light yellowish brown, yellowish brown, or grayish brown range from none to common. Calcium carbonate concretions range from few to about 10 percent, by volume.

Bunyan series

The Bunyan series consists of deep, loamy soils on bottom lands. They formed in stratified alluvium. They are subject to flooding more than once each 2 years for a period of 2 to 7 days during wet seasons. Slopes are less than 1 percent.

Typical pedon of Bunyan fine sandy loam, frequently flooded; from the intersection of Loop 288 and U.S. Highway 380 in Denton, 3.9 miles east on U. S. Highway 380, 0.5 mile north on county road, and 110 feet west of right-of-way into pasture:

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky and granular structure; soft, very friable; many fine and medium roots; neutral; clear smooth boundary.

C1—5 to 21 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable; few fine roots; few worm casts; few bedding planes; neutral; clear smooth boundary.

C2—21 to 42 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable; few thin dark brown (10YR 3/3) strata of clay loam less than 1/2 inch thick; few medium roots; moderately alkaline; diffuse boundary.

C3—42 to 66 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable; few fine black concretions; few thin strata of dark brown (10YR 3/3) clay loam; moderately alkaline.

The A horizon is grayish brown or brown. Reaction is slightly acid or neutral. Thin strata of darker and lighter colors range from none to few.

The C horizon is yellowish brown or brown. Mottles and strata of grayish brown and reddish yellow range from none to common. Texture is sandy clay loam, fine sandy loam, or loam. Reaction is slightly acid through moderately alkaline. Thin strata of dark brown clay loam range from few to common. Clay loam horizons are below a depth of 37 inches in some pedons.

Burleson series

The Burleson series consists of deep, clayey soils on upland terraces. They formed in ancient clayey alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Frisco Park Road and Farm Road 720 in Little Elm, 0.2 mile north on Frisco Park Road and 100 feet east of right-of-way into parkland in a microdepression:

A11—0 to 17 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few worm casts; neutral; clear wavy boundary.

A12—17 to 46 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on ped surfaces; common intersecting slickensides in the lower part; moderately alkaline; clear wavy boundary.

AC—46 to 59 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; few medium faint brown (10YR 5/3) mottles and dark gray (10YR 4/1) vertical streaks; strong coarse blocky structure; extremely hard, very firm, very sticky and plastic; common intersecting slickensides; few soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

C—59 to 80 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; massive; extremely hard, very firm, very sticky and plastic; few fine masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 43 to more than 90 inches thick, and it is more than 55 inches thick in more than 70 percent of any pedon.

The A horizon is gray, dark gray, or very dark gray. Reaction is medium acid through moderately alkaline. The matrix is noncalcareous to a depth of more than 30 inches in more than half of the pedon. The AC horizon is gray or dark gray. Mottles in shades of olive and brown range from none to common. Vertical streaks of dark gray or very dark gray range from few to common. Reaction is mildly alkaline or moderately alkaline.

The C horizon is gray, olive gray, dark gray, light brownish gray, grayish brown, or olive. Contrasting mottles in shades of brown, olive, or yellow range from none to common. Reaction is mildly alkaline or moderately alkaline.

Callisburg series

The Callisburg series consists of deep, loamy soils that formed in clay and clayey shale. Slopes range from 1 to 5 percent.

Typical pedon of Callisburg fine sandy loam, 1 to 3 percent slopes; from the intersection of Loop 288 and U.S. Highway 380 in Denton, 8.0 miles east on U.S. Highway 380, 0.6 mile south on private road, and 0.25 mile west into pasture:

A1—0 to 5 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; massive; very hard, very firm; common fine roots; few fine and medium pores; few black concretions; medium acid; abrupt wavy boundary.

B21t—5 to 13 inches; strong brown (7.5YR 5/6) sandy clay, strong brown (7.5YR 5/6) moist; strong medium and coarse blocky structure; extremely hard, very firm; few roots on ped surfaces; few fine pores; few clay films; few black concretions; slightly acid; gradual wavy boundary.

B22t—13 to 32 inches; yellowish brown (10YR 5/6) clay, yellowish brown (10YR 5/4) moist; few medium distinct pale brown (10YR 6/3) mottles; strong coarse blocky structure; extremely hard, very firm; common fine roots on ped surfaces; common clay films; neutral; diffuse boundary.

B23t—32 to 56 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; few fine faint strong brown and gray mottles; moderate coarse blocky structure; extremely hard, very firm; common clay films; few pitted calcium carbonate concretions below a depth of 44 inches; gray colors increase with depth; few peds coated with black in lower part; mildly alkaline; diffuse boundary.

B3—56 to 80 inches; yellowish brown (10YR 5/8) sandy clay loam, yellowish brown (10YR 5/8) moist; few fine faint strong brown and common coarse distinct light gray (N 7/0) mottles; moderate coarse blocky structure; extremely hard, very firm; few clay films; common black coatings on ped surfaces; mildly alkaline.

The solum ranges from 65 to more than 80 inches in thickness. Depth to calcium carbonate is 40 to 60 inches.

The A horizon is pale brown, brown, or grayish brown. Reaction is medium acid through neutral. A thin A2 horizon is in some pedons. It is one to two units in value lighter than the A1 horizon.

The B21t horizon is yellowish brown, reddish yellow, strong brown, or brown. Mottles of yellowish red or red range from none to common. Texture is clay loam, sandy clay loam, or sandy clay. Reaction is strongly acid through slightly acid. The B22t and B23t horizons are yellowish brown, brownish yellow, light yellowish brown, strong brown, or reddish yellow. Mottles of red, brown, pale brown, or gray range from few to common. Texture is clay or sandy clay. Reaction is medium acid through mildly alkaline.

The B3 horizon is yellowish brown, light yellowish brown, brown, strong brown, or yellowish red. It has few to common mottles of red, brown, or gray. Texture is clay, sandy clay, or sandy clay loam. Reaction is medium acid through moderately alkaline.

Crockett series

The Crockett series consists of deep, loamy soils that formed in alkaline marine clays. Slopes range from 0 to 3 percent.

Typical pedon of Crockett fine sandy loam, 1 to 3 percent slopes; from the entrance to Oakland Park in Lake Dallas, 1.0 mile southwest on park road and 600 feet west into parkland:

Ap—0 to 6 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak granular structure; slightly hard, very friable; many fine roots; neutral; abrupt wavy boundary.

B21t—6 to 15 inches; mottled reddish brown (2.5YR 4/4), light brownish gray (10YR 6/2), and reddish yellow (5YR 6/6) clay; moderate medium blocky structure; very hard, very firm; few roots on ped surfaces; few vertical streaks of Ap material in the upper part; medium acid; gradual wavy boundary.

B22t—15 to 27 inches; mottled light yellowish brown (10YR 6/4), light brownish gray (10YR 6/2), and reddish brown (2.5YR 5/4) clay; moderate and medium strong blocky structure; extremely hard, very firm; few roots; common clay films; few angular prisms and coarse slickensides below 20 inches; mildly alkaline; gradual wavy boundary.

B23t—27 to 43 inches; mottled grayish brown (10YR 5/2); red (2.5YR 5/6), and yellowish brown (10YR 5/4) clay; moderate coarse blocky structure; extremely hard, very firm; few roots; continuous clay films; common coarse slickensides; mildly alkaline; gradual wavy boundary.

B3—43 to 55 inches; mottled pale brown (10YR 6/3), light gray (10YR 6/1), and brownish yellow (10YR 6/6) clay; moderate medium blocky structure; extremely hard, very firm; few thin clay films; few fine calcium carbonate masses and concretions; mildly alkaline; diffuse boundary.

C—55 to 66 inches; mottled pale brown (10YR 6/3), light gray (10YR 6/1), and brownish yellow (10YR 6/6) clay; massive; extremely hard, very firm; few soft calcium carbonate masses and concretions; calcareous; moderately alkaline.

The solum ranges from 50 to more than 80 inches in thickness. Depth to visible calcium carbonate is 33 to 60 inches.

The A horizon is dark grayish brown, dark brown, brown, pale brown, or yellowish brown. Reaction is medium acid through neutral. A thin A2 horizon slightly lighter in color than the A1 horizon is in some pedons.

The Bt horizon has variable colors and is mottled in shades of brown, yellow, and red. The matrix is grayish brown, brown, or yellowish brown mottled with red, reddish brown, brown, or olive. Texture is clay or clay loam. Visible calcium carbonate ranges from none to few. Reaction is slightly acid through mildly alkaline.

The B3 and C horizons include colors of gray, light gray, or brownish gray in addition to those listed for the Bt horizon. Texture is clay, clay loam, or sandy clay.

Eddy series

The Eddy series consists of very shallow to shallow, loamy soils that formed on chalky limestone. Slopes range from 3 to 15 percent.

Typical pedon of Eddy gravelly clay loam, 3 to 15 percent slopes; from Hebron, 1.0 mile south on gravel county road and 300 feet east into rangeland:

A1—0 to 4 inches; grayish brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; common fine roots; about 20 percent chalk fragments 1/2 to 2 inches across; calcareous; moderately alkaline; clear smooth boundary.

A&C—4 to 8 inches; grayish brown (10YR 5/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; common medium roots; about 50 percent chalk fragments 2 to 8 inches long and 1/2 inch to 2 inches thick; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—8 to 20 inches; platy white fractured chalk; plates are 8 to 15 inches wide and become coarser with depth.

The thickness of the solum to chalky limestone is 3 to 12 inches. The soil is 20 to 90 percent chalk fragments. Texture of the fine earth is clay loam or loam.

The A horizon is light brownish gray, grayish brown, pale brown, or brown.

The Cr horizon ranges in hardness from 1 to 3 on Mohs scale.

Energy series

The Energy series consists of deep, loamy soils that formed in recent alluvium on flood plains. Slopes range from 0 to 1 percent. The soil floods one or more times each 1 to 5 years unless protection is provided.

Typical pedon of Energy fine sandy loam, frequently flooded; from the intersection of Interstate 35 and Farm Road 455 in Sanger, 2.4 miles west on Farm Road 455, 1.2 miles south on county road to south side of Clear Creek and 50 feet west of right-of-way in improved pasture:

Ap—0 to 4 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; weak granular structure; soft, very friable; calcareous; moderately alkaline; clear smooth boundary.

A11—4 to 7 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; loose, very friable; alternating 1/8 to 1/2 inch thick strata of pale brown fine sand and fine sandy loam; calcareous; moderately alkaline; clear smooth boundary.

A12—7 to 19 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; wavy 1- to 2-inch band of fine sand in the lower part; few pockets of dark brown (10YR 3/3) worm casts in the upper part; calcareous; moderately alkaline; clear smooth boundary.

C1—19 to 35 inches; stratified very pale brown (10YR 7/3) and brown (10YR 5/3) fine sandy loam; massive; loose, very friable; strata 1/8 to 1 inch thick; calcareous; moderately alkaline; abrupt smooth boundary.

C2—35 to 42 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; common fine faint very pale brown mottles; massive; loose, very friable; calcareous; moderately alkaline; clear smooth boundary.

IIA—42 to 60 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; calcareous; moderately alkaline.

Texture of the 10- to 40-inch control section is fine sandy loam or loam with thin strata of fine sand, loamy fine sand, or sandy clay loam.

The A horizon is brown, pale brown, light brownish gray, or very pale brown.

The C horizon is brown, pale brown, light brownish gray, or very pale brown. Contrasting brownish mottles range from none to common.

The IIA horizon is very dark gray, very dark grayish brown, or dark grayish brown. It is loam, clay loam, or sandy clay loam.

Ferris series

The Ferris series consists of deep, clayey soils formed in calcareous clayey marine sediments. Slopes range from 3 to 15 percent.

Typical pedon of Ferris clay, in an area of Ferris-Heiden clays, 5 to 15 percent slopes; from the intersection of Interstate Highway 35E and Texas Highway 121 in Lewisville, 7.0 miles east on Texas Highway 121, 0.5 mile south on county road, and 500 feet west into rangeland:

A1—0 to 6 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine blocky structure; extremely hard, very firm, very sticky and plastic; many fine and medium roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

AC1—6 to 23 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on ped surfaces; few worm casts; few fine calcium carbonate concretions; few fine siliceous pebbles; few slickensides in the lower part; calcareous; moderately alkaline; gradual wavy boundary.

AC2—23 to 43 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; strong coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on ped surfaces; common coarse slickensides; few vertical streaks of very dark grayish brown (2.5Y 3/2); few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

C—43 to 60 inches; olive yellow (2.5Y 6/6) shaly clay, light olive brown (2.5Y 5/6) moist; few fine distinct strong brown mottles; massive shale structure; extremely hard, very firm, sticky and plastic; few coarse slickensides; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches thick. Texture of the control section is clay with 40 to 60 percent clay. Calcium carbonate concretions range from few to common.

The A1 horizon is dark grayish brown or grayish brown. The AC horizon is light olive brown or light yellowish brown. Brown or strong brown mottles range from none to few.

The C horizon is olive yellow, light olive brown, or light yellowish brown with none to common brownish mottles. Gypsum crystals are in the C horizon of some pedons.

Frio series

The Frio series consists of deep, clayey soils that formed in recent alluvium on bottom land. Slopes range from 0 to 1 percent, and areas are subject to flooding.

Typical pedon of Frio silty clay, frequently flooded; from the intersection of Interstate Highway 35W and Interstate Highway 35E in Denton, about 2.7 miles south on Interstate Highway 35W, 2.6 miles west on Farm Road 2449, 1.6 miles north and 0.8 mile east on county road, and 1,200 feet south into wooded pasture:

A11—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.

A12—9 to 23 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak subangular blocky and medium fine granular structure; hard, firm, sticky and plastic; few fine roots; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

A13—23 to 64 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate medium subangular blocky and granular structure; hard, firm, sticky and plastic; few fine roots; few worm casts; few coarse sand grains; structure becomes coarser with depth; calcareous; moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. Thickness is 40 to more than 90 inches.

The C horizon, when present, is grayish brown or dark grayish brown. Texture is silty clay, clay loam, or silty clay loam.

Gasil series

The Gasil series consists of deep, loamy soils that formed in loamy material interbedded with sandstone. Slopes range from 1 to 8 percent.

Typical pedon of Gasil fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 1171 and Farm Road 2499 in Flower Mound, 1.5 miles south on Farm Road 2499, 1.0 mile west, 0.5 mile north, and 1.5 miles west on county road, and 200 feet north of right-of-way into pasture:

A1—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common fine roots; common medium pores; few fine and medium ironstone fragments; neutral; gradual smooth boundary.

B21t—7 to 16 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; strong medium subangular blocky structure; very hard, friable, slightly sticky; common roots; common pores; few worm casts; few fine ironstone fragments; clay bridging sand grains; neutral; gradual smooth boundary.

B22t—16 to 37 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; few fine faint strong brown mottles; weak coarse prismatic structure parting to moderate medium su-

bangular blocky; hard, friable, slightly sticky; few fine roots; few pores; few worm casts; few fine ironstone fragments; common clay films; medium acid; gradual smooth boundary.

B23t—37 to 57 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; few fine faint strong brown mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky; about 3 percent ironstone fragments less than 2.5 cm across; few clay films; medium acid; gradual wavy boundary.

B3—57 to 80 inches; mottled light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and red (2.5YR 5/6) sandy clay loam; strong coarse blocky structure; very hard, very firm, sticky and plastic; grayish mottles increase with depth; common clay films; neutral.

The solum ranges from 60 to more than 90 inches in thickness.

The A horizon is brown, yellowish brown, pale brown, or light yellowish brown. Reaction is slightly acid or neutral.

The B21t horizon is brown, yellowish brown, light yellowish brown, brownish yellow, or reddish yellow. It is mainly sandy clay loam but ranges to loam that is 18 to 30 percent clay. Reaction is medium acid through neutral.

The lower part of the Bt horizon is strong brown, light yellowish brown, brownish yellow, or very pale brown. Contrasting mottles of strong brown, yellowish brown, yellowish red, and red range from few to common. It is sandy clay loam that is 18 to 30 percent clay. Reaction is strongly acid through slightly acid.

The B3 and C horizons have colors similar to the horizons above and have gray mottles or strata. Texture is clay, sandy clay, or sandy clay loam. Reaction is strongly acid through slightly acid.

Gowen series

The Gowen series consists of deep, loamy soils that formed in recent alluvium on bottom land. Slopes range from 0 to 1 percent, and areas of the soil are subject to flooding.

Typical pedon of Gowen clay loam, occasionally flooded; from the intersection of Farm Road 2164 and Farm Road 428 in the north side of Denton, about 7 miles northeast on Farm Road 428, 1.8 miles north on Farm Road 2153, 1.1 miles east, 0.2 mile north, and 0.3 mile east on county road, and 200 feet north into pasture:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky and granular structure; hard, friable; many roots; few worm casts; neutral; abrupt smooth boundary.

A12—5 to 23 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, friable; many roots; few faint brown (7.5YR 5/4) stains on ped surfaces; few streaks of very pale brown (10YR 7/3) sand; few fine black concretions; neutral; gradual smooth boundary.

A13—23 to 45 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; few fine distinct brownish yellow mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; few black shotlike concretions; few streaks of sand; neutral; diffuse boundary.

C—45 to 65 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; massive; hard, firm; few thin strata of dark brown (10YR 3/3) loam less than 1/2 inch thick; few sand strata; occasional fine calcium carbonate concretions; noncalcareous; moderately alkaline.

Texture of the control section is loam, sandy clay loam, or clay loam that is 20 to 35 percent clay. Reaction is neutral through moderately alkaline. Thin strata of contrasting textures and colors range from none to few.

The A horizon is very dark grayish brown, dark grayish brown, or brown. Contrasting mottles of strong brown, brown, yellowish brown, or brownish yellow in the lower part of the A horizon range from none to few.

The C horizon is grayish brown or brown.

Heiden series

The Heiden series consists of deep, clayey soils that formed in clayey marine sediments. Slopes range from 1 to 15 percent.

Typical pedon of Heiden clay, 1 to 3 percent slopes; from the Hebron Baptist Church, 0.5 mile east, 0.2 mile south, and 0.3 mile west on county road, and 120 feet south into rangeland, at the center of a microdepression:

A1—0 to 17 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; many roots; common calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

AC1—17 to 48 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and plastic; common roots; common calcium carbonate concretions 1 to 5 mm across; common slickensides below 23 inches; few filled vertical cracks; calcareous; moderately alkaline; gradual wavy boundary.

AC2—48 to 66 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common fine olive yellow mottles; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; common calcium carbonate concretions and a few soft masses; few black concretions; common slickensides; calcareous; moderately alkaline; diffuse boundary.

C—66 to 80 inches; mottled olive yellow (2.5Y 6/6), gray (N 6/0), and brownish yellow (10YR 6/6) silty clay; massive in the upper part, thin platy below; few black concretions; few calcium carbonate concretions; few gypsum crystals; few slickensides; calcareous; moderately alkaline.

The solum ranges from 52 to more than 70 inches in thickness. The solum is thicker in microlows and thinner in microhighs. Texture is 40 to 60 percent clay.

The A horizon is very dark grayish brown or dark grayish brown. Some pedons have chroma of less than 2 to a depth of 6 to 10 inches in the center of the microlow.

The AC1 horizon is grayish brown or light olive brown. The AC2 horizon is light yellowish brown, yellowish brown, light olive brown, or olive. Mottles of yellow, brown, and gray range from few to common. The visible carbonates in the AC horizon range from few to about 2 percent.

The C horizon is mottled in shades of gray, brown, and yellow. Texture is marly clay, marly silty clay, or shaly clay.

Houston Black series

The Houston Black series consists of deep, clayey soils that formed in calcareous clays and marls. Slopes range from 0 to 3 percent.

Typical pedon of Houston Black clay, 0 to 1 percent slopes; from the intersection of Interstate Highway 35E and Texas Highway 121 in Lewisville, about 5 miles east on Texas Highway 121, 2.6 miles south and east on Farm Road 544, and 200 feet south into cropland in the center of a microdepression:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine subangular blocky and blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; aburpt smooth boundary.

A11—6 to 19 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

A12—19 to 31 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few coarse slickensides in the lower part; few calcium carbonate concretions up to 10 mm across; calcareous; moderately alkaline; diffuse boundary.

AC1—31 to 56 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; common coarse slickensides and parallelepipeds; few vertical streaks of black (10YR 2/1); few calcium carbonate concretions up to 10 mm across; calcareous; moderately alkaline; gradual wavy boundary.

AC2—56 to 80 inches; mottled brownish yellow (10YR 6/6), pale brown (10YR 6/3), and light yellowish brown (10YR 6/4) silty clay; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; few coarse slickensides; about 5 percent concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 90 inches in thickness. Intersecting slickensides begin 20 to 25 inches below the surface. Texture is clay or silty clay.

The A horizon is very dark gray or dark gray.

The AC1 horizon is dark grayish brown, grayish brown, or light yellowish brown. Mottles of very dark gray, dark gray, or olive yellow range from none to few. The AC2 horizon is light brownish gray, olive yellow, or is mottled in colors of yellowish brown, brownish yellow, pale brown, light yellowish brown, or light brownish gray. Visible soft masses and concretions of calcium carbonate range from few to about 5 percent. The calcium carbonate equivalent is 20 to 35 percent.

A mottled grayish brown, yellowish brown, gray, or yellow marly clay or shaly clay C horizon is in some pedons below a depth of 60 inches.

Justin series

The Justin series consists of deep, loamy soils that formed in alkaline clayey and loamy sediments. Slopes range from 0 to 5 percent.

Typical pedon of Justin fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 2164 and Farm Road 428 on the north side of Denton, about 7 miles northeast on Farm Road 428, 2.2 miles north on Farm Road 2153, and 300 feet west in pasture:

Ap—0 to 5 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; hard, friable; many fine roots; few fine pores; few fine nodules of ironstone; slightly acid; abrupt smooth boundary.

A1—5 to 12 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky and granular structure; slightly hard, friable; many fine roots; common fine pores; common worm casts; few fine nodules of ironstone; slightly acid; clear wavy boundary.

B21t—12 to 17 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; few fine faint red mottles; moderate medium subangular blocky structure; hard, friable; many fine roots; few fine pores; few discontinuous clay films on faces of peds; few fine nodules of ironstone; slightly acid; gradual smooth boundary.

B22t—17 to 33 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; common medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky and fine blocky structure; hard, friable; common fine roots; distinct clay films on faces of peds; neutral; gradual smooth boundary.

B23t—33 to 80 inches; brownish yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) moist; common medium distinct yellowish red (5YR 5/6) mottles; moderate medium blocky and subangular blocky structure; hard, friable; few fine roots; continuous clay films on faces of peds; few soft masses of calcium carbonate in the lower part; mildly alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to soft masses of calcium carbonate ranges from 36 to 70 inches. Content of fine nodules and fragments of ironstone range from none to about 5 percent throughout the solum.

The A horizon is dark grayish brown or brown. It is fine sandy loam and slightly acid or neutral.

The B21t horizon is brown, yellowish brown, pale brown, light yellowish brown, strong brown, yellowish red, or reddish brown. Mottles of dark red, red, yellowish red, or strong brown range from none to common. The B21t horizon is sandy clay loam, loam, or clay loam. Clay content ranges from 24 to 35 percent. Reaction is slightly acid or neutral. The B22t horizon is brown, grayish brown, light olive brown, yellowish brown, strong brown, reddish yellow, reddish brown, or yellowish red. It has common coarse red, yellowish red, or reddish yellow mottles in most pedons. Texture is clay loam or sandy clay loam. Clay content ranges from 24 to 40 percent. Reaction is slightly acid through mildly alkaline. The B23t horizon is red, yellowish red, brown, strong brown, yellowish brown, brownish yellow, or olive brown with contrasting red or brown mottles. Some pedons are mottled with 2 or more of these colors. Some pedons have grayish brown or gray mottles below a depth of 40 inches. Texture is clay loam or clay.

Some pedons have a C horizon of mottled brown, red, brownish gray, or gray sandy clay, sandy clay loam, or shaly clay below a depth of 60 inches. Reaction ranges from slightly acid through moderately alkaline.

Kaufman series

The Kaufman series consists of deep, clayey soils that formed in recent alluvium. The soils are on frequently flooded bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Kaufman clay, frequently flooded; from Denton, about 16 miles east on U.S. Highway 380 to Navo, 0.8 mile north and 0.2 mile west on county road, and 0.3 mile north of road into improved pasture:

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse blocky and subangular blocky structure; extremely hard, very firm, very plastic; few strongly cemented calcium carbonate concretions less than 5 mm across; 1-inch thick crust on surface has platy structure; mildly alkaline; abrupt smooth boundary.

A1—5 to 34 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; few medium faint mottles of very dark grayish brown (10YR 3/2) below 17 inches; strong coarse blocky structure; extremely hard, very firm, very plastic; common intersecting slickensides; few sand grains in mottles; few vertical streaks of very dark gray (10YR 3/1); mildly alkaline; diffuse wavy boundary.

ACg—34 to 57 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine faint mottles and vertical streaks of brown (10YR 5/3) and black (10YR 2/1); strong coarse blocky structure; extremely hard, very firm, very plastic; occasional calcium carbonate concretions strongly cemented; common intersecting slickensides; common wedge shaped parallelepipeds; noncalcareous; moderately alkaline; gradual wavy boundary.

C—57 to 64 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; massive; extremely hard, very firm, very plastic; few soft masses of calcium carbonate; noncalcareous; moderately alkaline.

The solum ranges from 41 to more than 55 inches in thickness. Depth to calcareous material is 31 to 60 inches. The texture of the control section is 60 to 70 percent clay.

The A horizon is very dark gray or dark gray. Reaction is neutral through moderately alkaline. The A horizon is noncalcareous. Some pedons have overwashes of other textures up to 8 inches thick. Mottles of very dark grayish brown or brown are in some profiles below a depth of 8 inches.

The ACg horizon is very dark gray, gray, or dark gray. Mottles of brown, yellowish brown, or dark yellowish brown are none to common. Reaction is neutral through moderately alkaline.

The C horizon, where present, is dark gray, dark grayish brown, or very dark grayish brown. Texture is clay or

silty clay. Thin strata of loamy textures are in some pedons.

Konsil series

The Konsil series consists of deep, loamy, soils on uplands that formed in loamy material and interbedded sandstone. Slopes range from 1 to 8 percent.

Typical pedon of Konsil fine sandy loam, 1 to 3 percent slopes; from the west end of West Georgia Street in Pilot Point, 2.4 miles west on county road, and 100 feet north of right-of-way into pasture:

A1—0 to 12 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable; common roots; neutral; gradual smooth boundary.

B21t—12 to 21 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, friable; common roots; few discontinuous clay films; slightly acid; diffuse boundary.

B22t—21 to 32 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; hard, friable; few roots; few clay films; slightly acid; gradual smooth boundary.

B23t—32 to 44 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium distinct red (2.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; few clay films; medium acid; gradual smooth boundary.

B3—44 to 66 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common coarse distinct red (2.5YR 5/6) and reddish yellow (5YR 6/6) mottles; weak subangular blocky structure; slightly hard, friable; few strata of soft sandstone; medium acid.

The solum ranges from 60 to more than 80 inches thick. Gravel of sandstone and ironstone throughout the profile ranges from none to about 3 percent, by volume.

Color of the A horizon is brown or pale brown. Reaction is slightly acid or neutral. An A2 horizon 2 to 7 inches thick is in some profiles. It is slightly lighter in color than the A1 horizon.

Color of the Bt horizon is reddish yellow, yellowish red, reddish brown, or red. Contrasting mottles in the lower part range from few to common and are red, yellowish red, and strong brown. Texture is sandy clay loam or clay loam. Reaction is medium acid or slightly acid.

The B3 horizon is strong brown, reddish yellow, yellowish brown, light yellowish brown, or brownish yellow with few to common coarse reddish mottles. Texture is fine sandy loam and sandy clay loam. Soft sandstone strata are in the B3 horizon in some pedons.

Some pedons have a Cr horizon below a depth of 60 inches. It is weakly cemented sandstone.

Lewisville series

The Lewisville series consists of deep, loamy soils that formed in alkaline deposits on stream terraces. Slopes range from 1 to 5 percent.

Typical pedon of Lewisville clay loam, 3 to 5 percent slopes; from the intersection of Loop 288 and U.S. Highway 380 in Denton, 2.2 miles east on U.S. Highway 380, 1.2 miles south on county road, and 150 feet west of right-of-way into pasture:

A1—0 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; occasional fine calcium carbonate concretions less than 5 mm across; calcareous; moderately alkaline; gradual wavy boundary.

B21ca—15 to 37 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; common strongly cemented calcium carbonate concretions up to 5 mm across; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—37 to 56 inches; light olive brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky and blocky structure; hard, friable; about 7 percent strongly cemented calcium carbonate concretions 10 to 20 mm across; calcareous; moderately alkaline; gradual wavy boundary.

B3ca—56 to 74 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; hard, friable; about 5 percent calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 40 to more than 70 inches thick.

Color of the A horizon is dark grayish brown or brown.

The B21ca horizon is grayish brown, brown, or yellowish brown. The B22ca and B3ca horizons are grayish brown, light yellowish brown, brown, light olive brown, or reddish yellow. Texture of the Bca horizon is silty clay or clay loam. The Bca horizon is 5 to 15 percent soft masses and concretions of visible calcium carbonate.

The C horizon, where present, has the same colors as the Bca horizon. Texture is clay loam, silty clay, or silty clay loam.

Lindale series

The Lindale series consists of deep, loamy soils that formed in marine clay and limestone. Slopes range from 1 to 5 percent.

Typical pedon of Lindale clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 380 and Interstate Highway 35 in Denton, 3.0 miles west on U.S. Highway 380, 0.3 mile north on county road, and 100 feet east of right-of-way into wooded pasture:

A1—0 to 6 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; many fine and medium roots; common medium pores; common worm casts; common fine pebbles of ironstone; slightly acid; clear smooth boundary.

B21t—6 to 16 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; common fine and medium roots; few patchy clay films; common fine pebbles of ironstone; mildly alkaline; gradual smooth boundary.

B22t—16 to 25 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few patchy clay films; about 10 percent fine subrounded ironstone fragments; moderately alkaline; gradual smooth boundary.

B3ca—25 to 32 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; common fine distinct mottles of strong brown; moderate medium blocky structure; extremely hard, very firm; few fine roots; about 2 percent fine fragments of ironstone; 3 percent fine masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1ca—32 to 43 inches; light brown (7.5YR 6/4) very gravelly clay, brown (7.5YR 5/4) moist; massive; extremely hard, very firm; about 60 percent by volume of limestone gravel, cobbles, and stones; about 10 percent masses of soft calcium carbonate; few fine fragments of ironstone; calcareous; moderately alkaline; diffuse boundary.

C2ca—43 to 65 inches; reddish yellow (7.5YR 6/6) gravelly clay, strong brown (7.5YR 5/6) moist; massive; hard, firm; about 30 percent soft masses of calcium carbonate; 20 percent limestone gravel and concretions of calcium carbonate; few fragments of ironstone; calcareous; moderately alkaline.

The solum thickness to the C horizon, which contains limestone gravel, cobbles, and stones, ranges from 20 to 40 inches. Depth to calcareous material ranges from 18 to 27 inches. Fragments of ironstone in the solum range from a few to 10 percent, by volume.

The A horizon is grayish brown, brown, or reddish brown. Reaction ranges from slightly acid through moderately alkaline.

The B2t horizon is brown, yellowish red, reddish brown, light reddish brown, or red. Texture is clay loam or clay, and ranges from 35 to 50 percent clay. Reaction ranges from slightly acid through moderately alkaline.

The B3 horizon is yellowish brown, brown, strong brown, or reddish brown. Contrasting mottles of strong brown or reddish brown range from none to common. Texture is clay loam, clay, silty clay, or silty clay loam. Concretions of calcium carbonate and fragments of limestone range from a few to 20 percent, by volume.

The Cca horizon is yellowish brown, strong brown, brown, light brown, or reddish yellow. The C1ca horizon is very gravelly silty clay, very gravelly clay, very cobbly clay, very cobbly clay loam, or very gravelly silty clay loam. It ranges from 45 to 80 percent coarse fragments of limestone; 35 to 50 percent gravel; 10 to 20 percent cobbles; and up to 10 percent flat fragments 3 to 5 feet long, 2 to 3 feet wide, and 1 to 6 inches thick. Cobble and stone content is variable within short distances. Soft masses of calcium carbonate are common to many. The C2ca horizon is silty clay, clay, gravelly silty clay, or gravelly clay. It contains 10 to 30 percent limestone gravel and cobbles and 15 to 40 percent soft bodies of calcium carbonate.

Medlin series

The Medlin series consists of deep, clayey soils that formed in alkaline clayey sediments. Slopes range from 5 to 15 percent.

Typical pedon of Medlin clay, from an area of Medlin-Sanger clays, 5 to 15 percent slopes; from the intersection of Interstate Highway 35W and Interstate Highway 35E in Denton, 3.5 miles south on Interstate Highway 35W, and 400 feet west of right-of-way into rangeland:

A1—0 to 6 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky and granular structure; extremely hard, very firm, sticky and plastic; many fine roots; few fine pebbles of quartz; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—6 to 30 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few fine pebbles of quartz; common concretions of calcium carbonate; few fine intersecting slickensides and parallelepipeds below a depth of 26 inches; calcareous; moderately alkaline; gradual wavy boundary.

AC2—30 to 49 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct yellowish brown mottles; moderate

coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common coarse intersecting slickensides; common vertical streaks of brown clay; about 10 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—49 to 70 inches; grayish brown (2.5YR 5/2) marly silty clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct yellowish brown and gray mottles; massive; extremely hard, very firm, slightly sticky and plastic; about 20 percent soft masses and concretions of calcium carbonate; few fine black concretions; calcareous; moderately alkaline.

The solum ranges from 35 to more than 60 inches thick. Texture throughout is clay or silty clay with a clay content ranging from 40 to 60 percent. In some areas the surface layer is stony clay. The soil is mildly alkaline or moderately alkaline and calcareous. Cracks extend to a depth of more than 20 inches for 90 to 150 cumulative days in most years. Intersecting slickensides begin at a depth of 15 to 30 inches. Most untilled areas have gilgai relief, in which microvalleys 4 to 12 feet wide and 3 to 8 inches deep and microridges 6 to 20 feet wide extend up and down the slope.

The A horizon is dark grayish brown, grayish brown, brown, olive brown, light olive brown, or olive. Where moist color values are less than 3.5, the horizon is less than 12 inches thick.

The AC horizon is grayish brown, pale brown, light yellowish brown, light olive brown, very pale brown, or pale yellow with or without mottles of gray, yellowish brown, olive brown, olive brown, olive yellow, or yellow. Soft bodies and concretions of visible calcium carbonate range from 5 to 12 percent. Calcium carbonate in the lower part ranges from 30 to 45 percent.

The C horizon is marly silty clay, shaly clay, or calcareous shale. It is grayish brown, brown, yellowish brown, pale yellow, or yellow with or without mottles of yellowish brown, gray, olive brown, or olive yellow. The calcium carbonate equivalent ranges from 45 to more than 60 percent.

Mingo series

The Mingo series consists of moderately deep, loamy soils that formed in limestone and clay. Slopes range from 1 to 3 percent.

Typical pedon of Mingo clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 156 and Farm Road 2449 in Ponder, 1.7 miles west on Farm Road 2449, 2.0 miles south on county road, and 200 feet east into idle cropland:

Ap—0 to 5 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine and very fine roots; few fine fragments of ironstone; mildly alkaline; clear smooth boundary.

A1—5 to 11 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium and fine subangular blocky structure; very hard, very firm; few fine and very fine roots; few fine fragments of ironstone; mildly alkaline; gradual wavy boundary.

B21t—11 to 20 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few thin patchy clay films mainly on vertical surfaces of peds; few fine fragments of ironstone; mildly alkaline; gradual wavy boundary.

B22t—20 to 29 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate medium and coarse blocky structure; very hard, very firm; common thin patchy clay films mainly on vertical surfaces of peds; few fine fragments of ironstone; calcareous; moderately alkaline; clear wavy boundary.

R—29 to 33 inches; fractured platy limestone interbedded with marly clay.

The solum ranges from 22 to 40 inches in thickness and depth to rock. Thickness of the mollic epipedon and depth to chroma of 4 or more is 20 to 40 inches.

The A horizon is brown, dark brown, or dark grayish brown. It ranges from neutral through moderately alkaline.

The COLE (coefficient of linear extensibility) of the B2t horizon ranges from 0.07 to 0.09, but the potential linear extensibility is less than 6 cm. The B2t horizon is reddish brown, brown, dark brown, dark grayish brown, or grayish brown. Clay content of the B2t horizon ranges from 35 to 55 percent. In many pedons the lower part of the B2t horizon ranges from neutral through moderately alkaline and is calcareous. Some pedons have a few concretions of calcium carbonate or fragments of limestone, mainly in the lower part.

The underlying limestone is coarsely fractured and is interbedded with calcareous clayey marl.

Navo series

The Navo series consists of deep, loamy soils that formed in alkaline clayey sediments. Slopes range from 0 to 5 percent.

Typical pedon of Navo clay loam, 1 to 3 percent slopes; from Flower Mound city offices, 0.4 mile north on paved county road, and 200 feet east of right-of-way into pasture:

Ap—0 to 5 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/2) moist; massive; very hard, very firm, sticky and plastic; few fine roots; few fine pores; few fine black concretions; slightly acid; clear smooth boundary.

B21t—5 to 10 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots mainly on surfaces of peds; few fine pores; few thin patchy clay films; few fine black concretions; medium acid; gradual wavy boundary.

B22t—10 to 22 inches; mottled weak red (2.5YR 4/2) and reddish brown (5YR 4/4) clay; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots on surfaces of peds; thin distinct clay films on vertical faces of peds; few fine black concretions; medium acid; diffuse clear boundary.

B23t—22 to 48 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; common fine distinct reddish brown mottles; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on surfaces of peds; thin, distinct clay films; few fine vertical streaks of darker material from above; few fine black concretions; few fine concretions of calcium carbonate; moderately alkaline; diffuse wavy boundary.

B24t—48 to 72 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; common fine distinct strong brown and gray mottles; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on surfaces of peds; few thin patchy clay films; few fine pebbles of quartz; few fine black concretions; few fine concretions of calcium carbonate; moderately alkaline; diffuse wavy boundary.

B3—72 to 80 inches; yellow (10YR 7/6) clay, brownish yellow (10YR 6/6) moist; few fine distinct gray mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few thin patchy clay films; about 5 percent concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches thick. Depth to soft powdery forms of calcium carbonate ranges from 30 to 80 inches.

The A horizon is grayish brown, dark grayish brown, or brown. It ranges from medium acid through neutral.

The upper part of the B2t horizon is clay or clay loam that has a clay content ranging from 35 to 55 percent. It ranges from medium acid through neutral. The B21t and B22t horizons are yellowish red, reddish yellow, strong brown, brown, grayish brown, or yellowish brown with mottles of higher chroma. Mottles of reddish gray, weak red, reddish brown, light reddish brown, or strong brown are in most pedons. The lower part of the B2t horizon is reddish brown, reddish yellow, grayish brown, light brownish gray, brown, light yellowish brown, or yellow with few to common red, brown, gray, or olive mottles. Reaction ranges from slightly acid through moderately alkaline and the lower parts of the horizon are commonly calcareous.

A C horizon of mottled red, brown, gray, and olive shaly clay is in some pedons below a depth of 60 inches.

Ovan series

The Ovan series consists of deep, clayey soils that formed in recent alluvium on bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Ovan clay, frequently flooded; from the intersection of Loop 288 and U.S. Highway 380 in Denton, about 16 miles east on U.S. Highway 380 to Navo, 0.8 mile south and 0.1 mile east on county road, 0.8 mile south on private road, and 300 feet southwest in rangeland. Site is 300 feet north of Doe Creek:

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium granular and moderate fine angular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few fine strongly cemented calcium carbonate concretions; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 25 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse angular blocky structure parting to medium blocky and subangular blocky; very hard, very firm, very sticky and plastic; common fine roots; few very fine pores; shiny pressure faces on peds; vertical cracks 1/2 inch wide extend through this horizon; calcareous; moderately alkaline; clear wavy boundary.

A12—25 to 66 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; few fine distinct dark reddish brown mottles; moderate medium and coarse angular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few very fine pores; few fine strongly cemented calcium carbonate concretions; few coarse intersecting slickensides; few parallelepipeds; calcareous; moderately alkaline; diffuse wavy boundary.

B2—66 to 80 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few medium faint brown (10YR 4/3) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few calcium carbonate films, threads, and weakly cemented concretions; few coarse slickensides and parallelepipeds; calcareous; moderately alkaline.

The solum ranges from 50 to more than 90 inches thick. When the soil is dry, cracks 0.5 to 1 inch wide extend to depths of 20 to 30 inches. COLE (coefficient of linear extensibility) ranges from 0.075 to 0.14. Calcium carbonate films, threads, or soft masses occur at a depth of 30 to more than 60 inches.

The A horizon is very dark grayish brown, dark brown, brown, dark grayish brown, grayish brown, or dark olive gray. Mottles of reddish brown, brown, and olive range from none to common in the 10- to 40-inch control section. Texture is clay that is 40 to 55 percent clay.

The B horizon is grayish brown, olive brown, brown, or yellowish brown, and it has brown or olive brown mottles in most pedons.

The C horizon, where present, is dark gray to olive. Some pedons have thin dark gray, grayish brown, or brown discontinuous strata of clay, sandy clay, or clay loam in the 10- to 40-inch control section.

Ponder series

The Ponder series consists of deep, loamy soils that formed in alkaline clayey marine sediments. Slopes range from 0 to 3 percent.

Typical pedon of Ponder loam, 1 to 3 percent slopes; from the intersection of Interstate Highway 35E and Interstate Highway 35W in Denton, 8.0 miles south on Interstate Highway 35W, 1.1 miles west on Crawford Road, 0.3 mile south on private road, and 320 feet south into pasture:

A1—0 to 7 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; massive; extremely hard, very firm; common fine roots; common fine pores; few flattened fragments of ironstone up to 1/2 inch across; neutral; abrupt smooth boundary.

B21t—7 to 16 inches; brown (7.5YR 5/4) clay, brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots on surfaces of peds; few discontinuous clay films; few vertical cracks; medium acid; gradual wavy boundary.

B22t—16 to 22 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; common fine prominent red mottles; weak coarse prismatic structure parting to moderate medium blocky; extremely hard, very firm, very sticky and plastic; few fine roots on surfaces of peds; common clay films; few fine slickensides in the lower part; few vertical cracks; few fine and medium black concretions; slightly acid; gradual wavy boundary.

B23t—22 to 62 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse blocky; extremely hard, very firm, very sticky and plastic; few fine roots on surfaces of peds; common clay films; few intersecting slickensides and wedge-shaped parallelepipeds; few vertical cracks 1/2 inch wide; few flattened fragments of ironstone up to 1 inch across; few fine strongly cemented concretions of calcium carbonate below a depth of 30 inches; neutral; diffuse boundary.

B3—62 to 80 inches; very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine slickensides and wedge-shaped parallelepipeds; about 5 percent strongly cemented concretions and soft masses of calcium carbonate; a few vertical streaks of darker material from above; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches thick. Depth to secondary carbonates ranges from 30 to 48 inches. The COLE (coefficient of linear extensibility) of the upper part of the B2t horizon ranges from 0.08 to 0.11. Virgin areas have indistinct gilgai microrelief. The distance from the center of the microvalley to the center of the microhigh ranges from 6 to 15 feet. Microridges are 3 to 6 inches higher than microvalleys.

The A horizon is dark brown, dark grayish brown, grayish brown, or brown. It is loam and is both hard and massive when dry. It ranges from medium acid through neutral.

The B21t horizon is dark grayish brown, brown, or light olive brown. It is clay with an average clay content of 40 to 55 percent. It ranges from medium acid through mildly alkaline. The B22t, B23t, and the B3 horizons are dark grayish brown, very pale brown, grayish brown, brown, light brown, light yellowish brown, or light olive brown. Contrasting mottles of red, reddish brown, yellowish red, yellowish brown, or brown range from none to common. These horizons are clay or silty clay with a clay content of 40 to 55 percent; reaction ranges from slightly acid through moderately alkaline.

A C horizon of yellowish brown, brown, pale brown, or brownish gray clay or silty clay is in some pedons below a depth of 60 inches.

Rayex series

The Rayex series consists of shallow, loamy soils that formed in shale and sandstone that is high in iron. Slopes range from 2 to 15 percent.

Typical pedon of Rayex fine sandy loam, in an area of Birome-Rayex-Aubrey complex, 2 to 15 percent slopes, from the intersection of U.S. Highway 377 and Texas Highway 114 in Roanoke, 1.9 miles east on Texas Highway 114, and 30 feet north of right-of-way into woods:

A1—0 to 4 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak granular structure; slightly hard, friable; few fine roots; common ironstone and sandstone gravel and fragments 1/2 inch to 2 inches across; neutral; clear smooth boundary.

A2—4 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, friable; few fine roots; common sand-

stone and ironstone gravel 1/2 inch to 1 inch across; neutral; clear smooth boundary.

B2t—7 to 15 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; strong coarse subangular blocky and blocky structrue; very hard, very firm; stone line of flat ironstone less than 1/2 inch thick at contact with lower layer; about 5 percent rounded sandstone fragments 1 to 4 inches across; strongly acid; abrupt wavy boundary.

Cr—15 to 35 inches; yellowish red (5YR 5/8) fractured sandstone interbedded with very strongly acid, red (2.5YR 4/6), yellowish red (5YR 5/6), and light gray (N 7/0) shaly clay; sandstone is less hard than 3 on Mohs scale.

The solum is 10 to 20 inches thick to underlying fractured sandstone.

The A horizon is brown, dark brown, pink, light brown, grayish brown, or very pale brown. It is fine sandy loam, gravelly fine sandy loam, loamy fine sand, and gravelly loamy fine. Fragments of sandstone 4 inches to 4 feet across are on the surface. The A horizon is medium acid through neutral.

The B2t horizon is yellowish red, red, light red, reddish yellow, strong brown, and reddish brown. It is clay loam, sandy clay, or clay with a clay content of 35 to 55 percent. It is medium acid through very strongly acid. Fragments of angular and subrounded ironstone and sandstone range from 2 to about 15 percent of the volume.

The Cr horizon is fractured, reddish, weakly cemented sandstone interbedded with red, brown, and gray shale and clay. Sandstone has a hardness of less than 3 on Mohs scale and can be cut with a spade. It is very strongly acid through slightly acid. The thickness of the shale and clay strata increases with depth. The strata contain few to common large subrounded sandstone fragments.

Sanger series

The Sanger series consists of deep, clayey soils that formed in alkaline marine sediments. Slopes range from 1 to 15 percent.

Typical pedon of Sanger clay, 1 to 3 percent slopes; from the intersection of Interstate Highway 35E and Interstate Highway 35W in Denton, 8.0 miles south on Interstate Highway 35E, 1.1 miles west on Crawford Road, and 800 feet south into cropland, at the center of a microdepression:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium granular and subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine calcium carbonate concretions; few fine black concretions; many fine roots; many worm casts; calcareous; moderately alkaline; clear smooth boundary.

A1—7 to 38 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse blocky structure; extremely hard, very firm, sticky and plastic; about 5 percent calcium carbonate concretions and soft masses; common roots on ped surfaces; common fine intersecting slickensides below 22 inches; calcareous; moderately alkaline; gradual wavy boundary.

AC1—38 to 55 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; few fine faint brownish yellow mottles; weak coarse blocky structure; hard, firm, sticky and plastic; few fine roots; few pores; about 3 percent fine calcium carbonate concretions; few fine black concretions; few tilted slickensides; calcareous; moderately alkaline; gradual wavy boundary.

AC2—55 to 69 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; common medium distinct light gray (10YR 7/2) mottles; weak coarse blocky structure; hard, firm, sticky and plastic; about 10 percent soft masses and fine concretions of calcium carbonate; few 1/2- to 1-inch clay balls with rock structure; calcareous; moderately alkaline; diffuse boundary.

C—69 to 80 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; common medium distinct very pale brown (10YR 7/3) mottles; massive; extremely hard, very firm; common coarse soft masses of calcium carbonate; few fossil shells; few black coatings on fractures; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches thick. When it is dry, cracks that are as much as 1 inch wide extend to depths of more than 20 inches. Intersecting slickensides begin at a depth of 16 to 24 inches. Texture throughout is silty clay or clay that is 35 to 50 percent silicate clay.

The A horizon is very dark grayish brown or dark grayish brown. The A horizon is dominantly moderately alkaline and calcareous, but ranges to mildly alkaline and noncalcareous in the upper 12 inches in the microdepressions of some pedons.

The AC1 horizon is grayish brown, brown, light brownish gray, light yellowish brown, light olive brown, or very pale brown. Mottles of brownish yellow, olive yellow, or yellow range from none to few. The AC2 horizon is grayish brown, pale brown, light brownish gray, yellowish brown, light yellowish brown, olive yellow, or very pale brown. Mottles of gray, light gray, yellowish brown, brownish yellow, or light olive brown range from few to common. The calcium carbonate equivalent of the AC horizon is 40 to 60 percent in more than half the pedon. A few fine black concretions are in most pedons.

The C horizon is mottled in colors of brown, gray, and yellow. Texture is clay, silty clay, or shaly clay, and remnants of limestone are in some pedons.

Seagoville series

The Seagoville series consists of deep, clayey soils that formed in recent alluvium on bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Seagoville clay, occasionally flooded; from the intersection of Interstate 35E and Texas Highway 121 in Lewisville, 1.0 mile east on Texas Highway 121, 1.9 miles south and 0.5 mile east on county road, and 2,000 feet north of road into strip mined area:

A11—0 to 11 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine blocky structure; very hard, firm, very sticky and plastic; common roots; many fine pores; common vertical cracks; calcareous; moderately alkaline; abrupt smooth boundary.

A12—11 to 28 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderately fine and medium blocky structure; very hard, firm, very sticky and plastic; common roots; many fine pores; common coarse intersecting slickensides; calcareous; moderately alkaline; clear wavy boundary.

IIAb—28 to 37 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; common fine yellowish brown mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; soft, friable; common roots; many pores; few fine black concretions; calcareous; moderately alkaline; diffuse boundary.

IIC—37 to 80 inches; brownish yellow (10YR 6/6) loamy sand, yellowish brown (10YR 5/6) moist; common medium distinct dark brown (7.5YR 4/4) mottles; single grain; loose, very friable; dark brown mottles and splotches of fine sandy loam; mildly alkaline.

The thickness of the solum or of the mollic epipedon is 23 to 55 inches. The weighted average clay content of the 10- to 40-inch control section is 35 to 40 percent. Depth to horizons that are less than 35 percent clay is 25 to 35 inches.

The A11 and A12 horizons are grayish brown or dark grayish brown. Texture is clay or silty clay that is 40 to 60 percent clay. Reaction is mildly alkaline or moderately alkaline. The COLE (coefficient of linear extensibility) is 0.08 to 0.12.

The IIAb horizon is dark brown or dark grayish brown. Mottles of yellowish brown, brown, strong brown, or reddish brown range from none to common. The IIAb horizon is fine sandy loam or sandy clay loam and ranges from 18 to 25 percent clay. It is mildly alkaline or moderately alkaline and calcareous.

Some pedons have a B2 horizon of yellowish brown, brown, or strong brown.

The IIC horizon is brownish yellow, yellowish brown, brown, pale brown, light yellowish brown, or strong brown. Texture is loamy fine sand or fine sand. Reaction is neutral through moderately alkaline.

Silawa series

The Silawa series consists of deep, sandy soils that formed on sloping high stream terraces. Slopes range from 2 to 5 percent.

Typical pedon of Silawa loamy fine sand, 2 to 5 percent slopes; from North Flower Mound water tower, 0.6 mile west on Farm Road 1171, 0.3 mile south and 0.5 mile west on county road, and 600 feet south into pasture:

A1—0 to 14 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; loose, very friable; common fine roots; few fine ironstone pebbles; slightly acid; clear smooth boundary.

B21t—14 to 27 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; slightly hard, very friable; few fine roots; few fine ironstone pebbles; slightly acid; gradual smooth boundary.

B22t—27 to 39 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable; few fine roots; few fine ironstone pebbles; medium acid; diffuse boundary.

B3—39 to 56 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common fine distinct red mottles; moderate fine subangular blocky structure; slightly hard, very firm; occasional fine sandstone fragments; medium acid; diffuse boundary.

C—56 to 60 inches; mottled brownish yellow (10YR 6/6) and red (2.5YR 4/6) loamy fine sand; single grain; loose, very friable; medium acid.

The solum ranges from 40 to more than 72 inches thick.

The A horizon is brown, dark yellowish brown, light yellowish brown, light brown, pale brown, or very pale brown. Reaction is medium acid or slightly acid. A thin lighter-colored A2 horizon is in some pedons.

The Bt horizon is reddish brown, red, light red, yellowish red, or reddish yellow. It is fine sandy loam or sandy clay loam. Reaction is slightly acid or medium acid.

The B3 horizon is reddish brown, red, or reddish yellow. A few contrasting reddish mottles are in most pedons. Texture is fine sandy loam or sandy clay loam. Reaction is medium acid or slightly acid.

The C horizon is mottled in shades of red, brown, and yellow. Texture is fine sandy loam or loamy fine sand.

Silstid series

The Silstid series consists of deep, sandy soils that formed in sandy and loamy material. Slopes range from 1 to 5 percent.

Typical pedon of Silstid loamy fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 380 and U.S. Highway 377 east of Denton, 3.9 miles north on U.S. Highway 377 and 300 feet west of right-of-way into timber:

A1—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; single grain; loose; many fine roots; neutral; clear smooth boundary.

A2—6 to 30 inches; very pale brown (10YR 8/4) loamy fine sand, yellow (10YR 7/6) moist; single grain; loose; few fine roots; slightly acid; abrupt wavy boundary.

B21t—30 to 33 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6); few medium faint strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; hard, very friable; few fine roots; medium acid; clear wavy boundary.

B22t—33 to 47 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; common medium distinct yellowish red (5YR 5/6) mottles in the upper part; weak coarse prismatic structure parting to weak subangular blocky; hard, very friable; common fine roots; thin patchy clay films; medium acid; gradual boundary.

B23t—47 to 72 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; many coarse distinct red (2.5YR 4/6) and light gray (10YR 6/1) mottles; weak coarse prismatic structure parting to weak subangular blocky; hard, very friable; thin continuous clay films; few fine roots; medium acid; clear boundary.

C—72 to 80 inches; mottled red (2.5YR 5/6), light gray (10YR 6/1) and brownish yellow (10YR 6/8) loamy fine sand; single grain; loose, very friable; slightly acid.

The solum ranges from 60 to more than 75 inches thick.

The A horizon is very pale brown, light yellowish brown, pale brown, or brown. Reaction is medium acid through neutral.

The B2t horizon is sandy clay loam that is 18 to 30 percent clay. It is very pale brown, yellow, brownish yellow, or yellowish brown. Most pedons are mottled with strong brown, yellowish red, or red. Red mottles increase with depth.

The C horizon, where present, is loamy fine sand, sandy loam, or sandy clay loam. It is mottled in shades of red, gray, and brown. Reaction is medium acid through neutral.

Slidell series

The Slidell series consists of deep, clayey soil that formed in alkaline clayey marine sediments. Slopes range from 1 to 3 percent.

Typical pedon of Slidell clay, 1 to 3 percent slopes; from the intersection of Farm Road 156 and Farm Road 1173 in Krum, 7.2 miles west and north on Farm Road 1173, 1.4 miles west on county road, and 800 feet south of road into pasture at the center of a microdepression:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky and granular structure; extremely hard, very firm, sticky and plastic; many fine roots; common fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 19 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; few fine dark grayish brown mottles in the lower part; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few fine pores; fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—19 to 32 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine pores; few slickensides and parallelepipeds; few vertical streaks of grayish brown (10YR 5/2); common fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—32 to 49 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine pores; common coarse slickensides; few vertical streaks of very dark gray (10YR 3/1); common fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

AC2—49 to 72 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct yellowish brown mottles; weak coarse blocky structure; extremely hard, very firm, sticky and plastic; few slickensides; few vertical streaks of very dark gray (10YR 3/1); common coarse concretions of calcium carbonate; calcareous; moderately alkaline; diffuse boundary.

C—72 to 80 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; common fine distinct olive yellow mottles; massive; very hard, very

firm; few vertical streaks of grayish brown (2.5Y 5/2); common coarse concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. When it is dry, cracks as much as 1 inch wide extend to a depth of more than 20 inches. Intersecting slickensides begin at a depth of 16 to 25 inches. In more than half of each pedon the calcium carbonate equivalent ranges from 40 to 60 percent in some part of the 10- to 40-inch control section. Texture throughout is silty clay or clay. Cycles of microdepressions and microknolls are repeated each 10 to 20 feet. In virgin areas, microknolls range from 3 to 16 inches higher than microdepressions.

The A horizon is very dark gray or dark gray. It is dominantly calcareous but is noncalcareous in the center of microdepressions in some pedons.

The AC1 horizon is dark grayish brown, grayish brown, brown, or light yellowish brown. Mottles of olive brown, brown, yellowish brown, or brownish yellow range from none to common. The AC2 horizon is grayish brown, brown, light yellowish brown, very pale brown, or pale yellow. Mottles of dark grayish brown, yellowish brown, grayish brown, brownish yellow, or yellow range from few to common. Soft bodies and concretions of calcium carbonate range from 2 to 5 percent of the AC horizon and are more common in microknolls.

The C horizon is pale brown or light brownish gray and is mottled with olive brown, gray, brownish yellow, olive yellow, or yellow. Some pedons have fractured limestone interbedded with marly silty clay or silty clay loam below a depth of 70 inches.

Somervell series

The Somervell series consists of moderately deep, loamy soils that formed in gravelly loamy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Somervell gravelly loam, 1 to 5 percent slopes; from the intersection of Farm Road 455 and Farm Road 1173 about 10 miles west of Sanger, 0.4 mile west on Farm Road 455, 2.0 miles north on county road, and 180 feet west into rangeland:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many roots; common worm casts; 15 to 20 percent calcium carbonate gravel 2 mm to 2 inches across; calcareous; moderately alkaline; clear smooth boundary.

A12—5 to 15 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many roots; few worm casts; 60 percent limestone gravel and cobbles 2 mm to 6 inches across and coated with calcium; size of gravel and cobbles increases with depth, hardness is about 2 on Mohs scale; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—15 to 27 inches; light yellowish brown (2.5Y 6/4) very gravelly clay loam, light olive brown (2.5Y 5/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky and granular; slightly hard, friable; 40 to 50 percent limestone gravel and cobbles coated with calcium carbonate in stone lines between strata of clay loam; common vertical streaks of material from A horizon in upper 5 inches; calcareous; moderately alkaline; abrupt wavy boundary.

R—27 to 35 inches; hard, fractured limestone rock with light yellowish brown (2.5Y 6/4), light gray (2.5Y 7/2), and yellow (2.5Y 7/6) limy earth in fractures; fractures 1/4 to 1/2 inch wide.

The solum ranges from 20 to 30 inches thick. The calcium carbonate equivalent of the control section is 40 to more than 60 percent.

The A horizon is brown, dark grayish brown, or grayish brown. Limestone gravel and cobbles range from 15 to 75 percent.

The B2ca horizon is pale brown, light brownish gray, or light yellowish brown. Texture is very gravelly loam or very gravelly clay loam with 35 to 85 percent limestone gravel and cobbles. A stone line 2 to 6 inches thick is in some pedons.

Speck series

The Speck series consists of shallow, loamy soils that formed in alkaline clays over hard limestone. Slopes range from 1 to 3 percent.

Typical pedon of Speck clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 380 and Interstate Highway 35 in Denton, 0.6 mile south on Interstate Highway 35 access road, 3.6 miles west on paved county road, 0.7 mile south on gravel county road, and 115 feet west into rangeland:

A1—0 to 7 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; hard, friable; many fine roots; few smooth ironstone fragments less than 1/2 inch across the long axis; neutral; gradual smooth boundary.

B2t—7 to 15 inches; dark reddish brown (5YR 3/4) clay dark reddish brown (5YR 3/4) moist; moderate medium granular and subangular blocky structure; hard, firm; many fine roots; common fine ironstone fragments 1/2 inch across the long axis; few fine calcium carbonate fragments; few faint clay films; mildly alkaline; abrupt wavy boundary.

R—15 to 18 inches; fractured very hard limestone rock; upper 3 inches of rock rounded, 1 to 6 inches in diameter with interspaces filled with softer limestone; becomes coarse platy underneath.

The solum ranges from 14 to 18 inches thick. Soil reaction is neutral or mildly alkaline. The soil is noncalcareous in native range conditions. Coarse fragments of limestone on the soil surface range from none to 15 percent.

The A horizon is reddish brown or brown. The Bt horizon is dark reddish brown, reddish brown, or brown. Texture is clay with clay content of 40 to 55 percent.

The R layer is fractured limestone or shell conglomerate. Secondary lime occurs as coatings on fragments and in fractures.

Stephen series

The Stephen series consists of shallow clayey soils that formed in chalky limestone. Slopes range from 1 to 5 percent.

Typical pedon of Stephen silty clay, 1 to 5 percent slopes; from Hebron, 2.5 miles south on county road and 255 feet west into pasture:

A1—0 to 8 inches; brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) moist; strong fine to coarse granular structure; hard, very friable; many fine roots; common worm casts; few fine chalk fragments; few fine black concretions; calcareous; moderately alkaline; aburpt smooth boundary.

C1&A—8 to 14 inches; brown (7.5YR 5/2) very gravelly silty clay, dark brown (7.5YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, friable; few fine roots; about 80 percent of mass composed of chalk fragments 1/2 inch to 6 inches long; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—14 inches to 20 inches; fractured, white platy chalk that has a hardness of less than 3 on Mohs scale.

Solum thickness to chalk is 13 to 18 inches. The A horizon is brown, grayish brown, or dark grayish brown. Texture is silty clay or silty clay loam that is 35 to 50 percent clay. Chalk fragments are few to 15 percent of the volume.

The C&A horizon is 50 to 90 percent chalk fragments.

Trinity series

The Trinity series consists of deep, clayey soils that formed in recent clayey alluvium on bottom land. Slopes range from 0 to 1 percent.

Typical pedon of Trinity clay, occasionally flooded; from the intersection of Texas Highway 121 and Interstate Highway 35E in Lewisville, 1.0 mile east on Texas Highway 121, 1.2 miles south on county road, and 200 feet west of right-of-way into cropland:

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak subangular blocky and granular structure; very hard, firm; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

A11—5 to 44 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, firm; shiny pressure faces on peds; intersecting slickensides at 18 inches; calcareous; moderately alkaline; gradual smooth boundary.

A12—44 to 60 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak blocky structure; very hard, firm; few fine pitted calcium carbonate concretions; few slickensides and parallelepipeds; calcareous; moderately alkaline.

Solum thickness is 60 to more than 75 inches. The soil is moderately alkaline and calcareous throughout. Texture is clay, and clay content is 60 to 75 percent.

The A horizon is very dark gray or black. Thin strata of less clayey material are in the A1 horizon of some profiles.

The C horizon of dark gray or gray is below a depth of 60 inches in some profiles.

Vertel series

The Vertel series consists of moderately deep, clayey soils that formed in clayey shale. Slopes range from 1 to 12 percent.

Typical pedon of Vertel clay, 3 to 5 percent slopes; from the intersection of Interstate Highway 35E and Texas Highway 121 in Lewisville, 6.6 miles east on Texas Highway 121, 3.7 miles north on Farm Road 423, and 300 feet west into rangeland:

A1—0 to 6 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine and medium roots; many vertical cracks 0.5 inch to 1.5 inches wide; neutral; gradual wavy boundary.

AC—6 to 33 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common vertical cracks 1/2 inch wide; common intersecting slickensides and wedge-shaped parallelepipeds below a depth of 20 inches; common angular gypsum crystals; mildly alkaline; clear wavy boundary.

Cr—33 to 66 inches; stratified dark gray (10YR 4/1), yellowish brown (10YR 5/8), yellow (10YR 8/6), and yellowish red (5YR 4/6) very shaly clay; medium and coarse platy rock structure; extremely hard, very firm; few vertical cracks in the upper part; few gypsum crystals; medium acid.

The solum ranges from 24 to 40 inches thick. Clay content of the A and AC horizons is 60 to 76 percent. When the soil is dry, cracks 0.5 inch to 1.5 inches wide extend into the upper part of the C horizon. Untilled areas have a gilgai microrelief. Microvalleys 1 foot to 3 feet wide and 2 to 8 inches deep and microridges 10 to 16 feet wide extend up and down slopes.

The A horizon is dark grayish brown, grayish brown, olive, or pale olive. Reaction is neutral through moderately alkaline, and the soil is noncalcareous in more than half of any pedon. The AC horizon is dark grayish brown, grayish brown, olive gray, olive, light olive brown, light brownish gray, light olive gray, pale olive, light yellowish brown, or olive yellow. Mottles of yellowish brown, olive brown, brown, or yellowish red range from none to common. Reaction is neutral through moderately alkaline. Gypsum crystals range from few to common. Some pedons have a few fine strongly cemented calcium carbonate concretions.

The Cr horizon is weathered shale or very shaly clay. It is stratified gray and yellowish brown or yellow. Some pedons have olive brown or yellowish red strata. Reaction is medium acid through moderately alkaline. Gypsum crystals are few to common.

Wilson series

The Wilson series consists of deep, loamy soils that formed in alkaline clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Wilson clay loam, 1 to 3 percent slopes; from the intersection of Interstate Highway 35E and Farm Road 407 in Lewisville, 0.5 mile west on Farm Road 407, 1.0 mile south and 1.0 mile west on county road, and 600 feet northwest into pasture:

Ap—0 to 5 inches; gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure; very hard, friable; few fine roots; few pores; slightly acid; abrupt smooth boundary.

B21tg—5 to 34 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm; few roots; few intersecting slickensides below a depth of 26 inches; common pressure faces throughout; slightly acid; gradual wavy boundary.

B22tg—34 to 43 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; extremely hard, very firm; few fine gypsum crystals; few fine strongly cemented calcium carbonate concretions; vertical cracks filled with material from B21tg horizon; common pressure faces; moderately alkaline; gradual wavy boundary.

B23tg—43 to 52 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) dry; moderate medium and coarse blocky structure; extremely hard, very firm; occasional fine black concretions; few gypsum crystals; few fine strongly cemented calcium carbonate concretions; moderately alkaline; diffuse wavy boundary.

C—52 to 64 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) dry; few fine distinct yellowish brown mottles; strong coarse blocky structure; extremely hard, very firm; occasional gypsum crystals; mottles become coarser with depth; moderately alkaline.

The solum ranges from 50 to 85 inches thick.

The A horizon is very dark gray, gray, dark grayish brown, or dark gray. Reaction is medium acid through neutral. The A12 horizon, where present, is dark brown, dark gray, grayish brown, or light brownish gray. Texture is loam, clay loam, or silty clay loam. Clean sand grains are in the A12 horizon in most profiles.

The Btg horizon is dark gray, gray, or light gray to a depth of 30 inches or more. Below 30 inches the color is grayish brown or light brownish gray in addition to shades listed for the upper 30 inches. Texture is clay or silty clay. Common fine distinct mottles of dark yellowish brown, dark brown, or yellowish brown are in the lower part of the Btg horizon of most profiles. Reaction is slightly acid through moderately alkaline. The soil is noncalcareous, but fine strongly cemented calcium carbonate concretions are in most profiles. The Btg horizon has common filled vertical cracks and shiny pressure faces. There are no gypsum crystals in some profiles.

The B3 and C horizons have the same colors as the Btg horizon. Texture is clay or silty clay.

Formation of soils

This section discusses how soils form and the factors involved in their formation. It discusses briefly how parent material, climate, plant and animal life, relief, and time influence soil characteristics.

Parent material

The soils of Denton County formed in several kinds of parent material. They are included in four geologic systems—the Lower Cretaceous, Upper Cretaceous, Pleistocene, and Recent.

The Lower Cretaceous System includes the Kiamichi Formation, Goodland Limestone, Fort Worth Limestone,

Duck Creek Formation, Pawpaw Formation, Weno Limestone, Denton Clay, and Grayson Marl.

The Kiamichi Formation is mainly marl and limestone. The dominant soils that formed from this parent material are in the Aledo and Somervell series.

The Goodland Limestone is mainly limestone that grades into marly shale. It is the parent material of some Aledo, Medlin, Sanger, and Somervell soils.

The Fort Worth and Duck Creek Formations consist of interbedded limestone and marl. Bolar and Somervell soils on high residual landscape and Sanger and Slidell soils in more level areas and valley fills formed from this parent material.

The Pawpaw-Weno-Denton formation is not divided in Denton County. The Pawpaw Formation is mainly red clay high in iron interbedded with limestone. It is the parent material of the Lindale, Mingo, and Speck soils. The Weno Limestone is interbedded marl and limestone, and the dominant soils that formed from it are Bolar and Somervell soils. The Denton clay is mainly calcareous clay. Dominant soils derived from it are Ponder and Sanger soils.

The Grayson Marl is mainly marl with thin beds of limestone. It is dominantly the parent material of Burleson, Lindale, Medlin, Ponder, Sanger, and Slidell soils.

The Upper Cretaceous System includes the Woodbine Formation, Eagle Ford Formation, and Austin Group.

The Woodbine Formation is not subdivided in Denton County. It is mainly alternating bands of sandstone, shale, and clay. The main soils derived from it include Birome, Callisburg, Gasil, Konsil, and Silstid soils.

The Eagle Ford Formation is primarily shale that underlies the rolling Blackland Prairies of Denton County. The dominant soils that formed from it include Burleson, Crockett, Ferris, Heiden, Houston Black, Navo, Wilson, and Vertel soils.

The Austin Group is mainly chalk. It occupies only a small part of the country. The main soils derived from it are Eddy and Stephen soils.

The Pleistocene System is primarily fluviatile terrace deposits of mixed origin. The dominant soils derived from it are Altoga, Bastrop, Branyon, and Lewisville soils.

The Recent System is alluvium along the flood plains. The major bottom land soils that formed in the material are the Bunyan, Energy, Frio, Gowen, Kaufman, Ovan, Seagoville, and Trinity soils.

Climate

The climate of Denton County is humid subtropical with hot summers. The climate is uniform throughout the county. Rainfall is sufficient to leach the calcium carbonate from the upper horizons of some soils but is not enough to leach it entirely out of the soil profile. Clay particles have moved down to form very slowly permeable horizons. Crockett, Navo, and Wilson soils are an example.

Plants and animals

Plant and animal life are important in the formation of soils. The kinds and amounts of plants are determined partly by climate and parent material. Decaying leaves, stems, and roots contribute organic matter to soils and give them dark colors. Growing roots form channels for water and air. Animal life in the form of bacteria, fungi and other micro-organisms, insects, and earthworms contribute to soil fertility and physical condition. Cultivation reduces the plant cover, and decreases pore space for movement of air and water, reduces animal life, and lowers soil fertility.

Relief

Slope affects soil development by influencing drainage and runoff. If other factors are equal, profile development depends on the amount of water that enters the soil. Steep soils absorb less moisture and usually have less well developed profiles than gently sloping soils. Some soils in low areas that receive water from adjacent slopes are wet for longer periods of time.

On steep soils, runoff is so great that geologic erosion almost keeps pace with soil development. Soils that formed in similar parent material but in different positions on the landscape often have unlike profiles. Distinctness of horizons and thickness of the solum are closely related to relief. Gently sloping soils generally have a thick solum and a distinct profile. Steeper soils have a thinner solum and less distinct horizons.

Time

The degree of soil development that takes place through interaction of parent material, climate, plants and animals, and relief depends upon time. Mature profiles that have well defined horizons develop only after long periods of time. Callisburg soils have well developed profiles with distinct horizons. Ovan soils are younger and less developed.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Texas Conservation Needs Committee. 1970. Conservation needs inventory. U.S. Dep. Agric., Soil Conservation Serv. 297 pp., illus.

(4) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp.,

illus. [Supplements replacing pp. 173-188 issued May 1962]
(5) United States Department of Agriculture. 1965. Predicting rainfall-erosion losses from cropland east of the rocky mountains. Agr. Res. Serv. U.S. Dep. Agric. Handb. 282. 47 pp.
(6) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden

deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced

by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parallelepiped. Wedge-shaped aggregate formed by shrinking and swelling of clayey soils.

Parent material. The inconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that

water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from

4 to 10 inches (10 to 25 centimeters). Frequently designated as the 'plow layer,' or the 'Ap horizon.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Means and extremes recorded at Denton, Texas, 1931-69]

Month	Temperature								Precipitation				
	Means			Extremes		Mean number of days with temperatures			Mean	Greatest daily	Number of days with 0.1 inch or more	Snow, sleet	
	Daily maximum	Daily minimum	Monthly	Record highest	Record lowest	Maximum of-- 90° or more	Maximum of-- 32° or less	Minimum of 32° or less				Mean	Maximum monthly
	°F	°F	°F	°F	°F				In	In		In	In
January	57.0	32.9	45.0	90	-3	*	2	17	1.88	1.85	3	1.0	8.0
February	61.0	36.1	48.6	88	-2	0	*	12	2.31	2.83	3	0.4	5.5
March	68.4	41.4	54.9	96	5	*	*	6	2.62	3.47	5	0.2	7.0
April	77.2	52.7	65.0	95	25	1	0	1	3.81	3.44	6	**	0.2
May	83.5	60.9	72.2	99	35	6	0	0	4.86	4.42	6	0	0
June	91.6	69.0	80.3	106	48	20	0	0	3.20	3.86	5	0	0
July	95.9	72.4	84.2	113	53	28	0	0	1.93	3.49	3	0	0
August	97.3	72.2	84.8	113	52	28	0	0	1.84	2.48	4	0	0
September	90.1	65.2	77.7	111	36	15	0	0	2.83	4.73	4	0	0
October	80.8	54.8	67.8	103	27	4	0	*	2.47	2.53	4	0	0
November	67.8	41.6	54.7	89	10	0	0	5	2.00	3.52	4	**	0.5
December	59.0	35.7	47.4	89	5	0	*	12	2.24	2.96	4	0.3	4.0
Year	77.5	52.9	65.2	113	-3	102	2	53	31.99	4.73	51	1.9	8.0

* Less than one half.
** Less than 0.05.

TABLE 2.--POTENTIALS AND LIMITATIONS OF MAP UNITS FOR SPECIFIED USES

Map unit	Percent of area	Cultivated farm crops	Pasture	Rangeland	Urban uses	Recreation
1. Birome-Gasil-Callisburg--	24	Medium: slopes, erodes easily.	Medium: low fertility.	Medium: low fertility.	High----------	High.
2. Sanger-Somervell---------	23	Medium: erodes easily, depth to rock.	Medium: depth to rock.	Medium: depth to rock.	Medium: shrink-swell, depth to rock, corrosive.	Medium: too clayey, percs slowly.
3. Navo-Wilson----------	12	Medium: wetness, erodes easily.	High----------	Medium: wetness.	Medium: shrink-swell, wetness, low strength, corrosive.	Low: too clayey, percs slowly.
4. Branyon-Burleson-Heiden--	7	High----------	High----------	High----------	Low: shrink-swell, low strength.	Low: too clayey, percs slowly.
5. Altoga-Vertel-Ferris-----	7	Medium: erodes easily, droughty.	Medium: droughty, erodes easily.	High----------	Low: shrink-swell, slope, corrosive.	Low: percs slowly, too clayey, slope.
6. Slidell-Sanger----------	6	High----------	High----------	High----------	Low: shrink-swell, low strength, corrosive.	Low: percs slowly, too clayey.
7. Ponder-Lindale----------	6	Medium: erodes easily.	High----------	High----------	Medium: shrink-swell, low strength, corrosive.	Medium: percs slowly, too clayey.
8. Frio-Ovan----------	11	Medium: flooding.	High----------	High----------	Very low: flooding.	Low: flooding.
9. Aledo-Somervell----------	3	Low: depth to rock, slope.	Low: depth to rock.	Low: depth to rock.	Medium: depth to rock, slope.	Medium: depth to rock.
10. Houston Black-Stephen---	1	Medium: depth to rock.	Medium: depth to rock.	Medium: depth to rock.	Medium: shrink-swell, depth to rock.	Low: too clayey, percs slowly.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aledo association, undulating	12,380	2.0
2	Altoga silty clay, 3 to 5 percent slopes	5,220	0.8
3	Altoga silty clay, 5 to 8 percent slopes	3,250	0.5
4	Altoga silty clay, 5 to 12 percent slopes, eroded	450	0.1
5	Aquilla loamy fine sand, 2 to 5 percent slopes	420	0.1
6	Arents, gently undulating	450	0.1
7	Arents, hilly	1,760	0.3
8	Aubrey fine sandy loam, 2 to 5 percent slopes	500	0.1
9	Bastrop fine sandy loam, 1 to 3 percent slopes	4,250	0.7
10	Bastrop fine sandy loam, 3 to 5 percent slopes	1,000	0.2
11	Birome fine sandy loam, 1 to 3 percent slopes	3,150	0.5
12	Birome fine sandy loam, 3 to 5 percent slopes	20,800	3.4
13	Birome-Rayex-Aubrey complex, 2 to 15 percent slopes	19,040	3.1
14	Birome-Rayex-Urban land complex, 2 to 12 percent slopes	1,020	0.2
15	Birome-Urban land complex, 1 to 5 percent slopes	1,490	0.2
16	Bolar clay loam, 1 to 3 percent slopes	1,780	0.3
17	Bolar clay loam, 3 to 5 percent slopes	2,390	0.4
18	Branyon clay, 0 to 1 percent slopes	16,820	2.7
19	Branyon clay, 1 to 3 percent slopes	8,460	1.4
20	Bunyan fine sandy loam, frequently flooded	2,920	0.5
21	Burleson clay, 0 to 1 percent slopes	9,400	1.5
22	Burleson clay, 1 to 3 percent slopes	14,520	2.4
23	Callisburg fine sandy loam, 1 to 3 percent slopes	18,610	3.0
24	Callisburg fine sandy loam, 3 to 5 percent slopes	4,870	0.8
25	Callisburg soils, 2 to 5 percent slopes, severely eroded	1,900	0.3
26	Crockett fine sandy loam, 0 to 1 percent slopes	2,780	0.4
27	Crockett fine sandy loam, 1 to 3 percent slopes	7,260	1.2
28	Crockett-Urban land complex, 0 to 2 percent slopes	1,800	0.3
29	Eddy gravelly clay loam, 3 to 15 percent slopes	530	0.1
30	Energy fine sandy loam, frequently flooded	2,250	0.4
31	Ferris-Heiden clays, 3 to 5 percent slopes	2,120	0.3
32	Ferris-Heiden clays, 5 to 15 percent slopes	5,520	0.9
33	Frio silty clay, occasionally flooded	8,830	1.4
34	Frio silty clay, frequently flooded	19,700	3.2
35	Gasil fine sandy loam, 1 to 3 percent slopes	18,130	3.0
36	Gasil fine sandy loam, 3 to 8 percent slopes	9,100	1.5
37	Gasil-Urban land complex, 1 to 4 percent slopes	2,630	0.4
38	Gasil and Konsil soils, 1 to 5 percent slopes	460	0.1
39	Gowen clay loam, occasionally flooded	3,740	0.6
40	Gowen clay loam, frequently flooded	3,380	0.5
41	Heiden clay, 1 to 3 percent slopes	10,710	1.7
42	Heiden clay, 3 to 5 percent slopes	7,970	1.3
43	Houston Black clay, 0 to 1 percent slopes	1,110	0.2
44	Houston Black clay, 1 to 3 percent slopes	2,440	0.4
45	Justin fine sandy loam, 0 to 1 percent slopes	1,510	0.2
46	Justin fine sandy loam, 1 to 3 percent slopes	10,570	1.7
47	Justin fine sandy loam, 3 to 5 percent slopes	1,060	0.2
48	Justin-Urban land complex, 0 to 3 percent slopes	1,910	0.3
49	Kaufman clay, frequently flooded	2,320	0.4
50	Konsil fine sandy loam, 1 to 3 percent slopes	5,220	0.9
51	Konsil fine sandy loam, 3 to 8 percent slopes	4,270	0.7
52	Lewisville clay loam, 1 to 3 percent slopes	2,150	0.4
53	Lewisville clay loam, 3 to 5 percent slopes	2,680	0.4
54	Lindale clay loam, 1 to 3 percent slopes	7,410	1.2
55	Lindale-Urban land complex, 1 to 5 percent slopes	610	0.1
56	Medlin-Sanger clays, 5 to 15 percent slopes	5,510	0.9
57	Medlin-Sanger stony clays, 5 to 12 percent slopes	5,660	0.9
58	Mingo clay loam, 1 to 3 percent slopes	12,000	2.0
59	Navo clay loam, 0 to 1 percent slopes	1,640	0.3
60	Navo clay loam, 1 to 3 percent slopes	22,170	3.6
61	Navo clay loam, 3 to 5 percent slopes	6,630	1.1
62	Navo-Urban land complex, 0 to 3 percent slopes	1,000	0.2
63	Ovan clay, occasionally flooded	4,760	0.8
64	Ovan clay, frequently flooded	12,270	2.0
65	Ponder loam, 0 to 1 percent slopes	1,690	0.3
66	Ponder loam, 1 to 3 percent slopes	21,560	3.5
67	Sanger clay, 1 to 3 percent slopes	50,750	8.3
68	Sanger clay, 3 to 5 percent slopes	17,800	2.9
69	Sanger-Urban land complex, 1 to 4 percent slopes	1,220	0.2
70	Seagoville clay, occasionally flooded	800	0.1
71	Silawa loamy fine sand, 2 to 5 percent slopes	2,190	0.4
72	Silstid loamy fine sand, 1 to 5 percent slopes	4,520	0.7

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
73	Silstid-Urban land complex, 1 to 5 percent slopes	570	0.1
74	Slidell clay, 1 to 3 percent slopes	26,898	4.4
75	Somervell gravelly loam, 1 to 5 percent slopes	31,150	5.1
76	Speck clay loam, 1 to 3 percent slopes	1,090	0.2
77	Stephen silty clay, 1 to 5 percent slopes	2,130	0.3
78	Trinity clay, occasionally flooded	6,700	1.1
79	Trinity clay, frequently flooded	1,440	0.2
80	Vertel clay, 1 to 3 percent slopes	2,380	0.4
81	Vertel clay, 3 to 5 percent slopes	4,600	0.8
82	Vertel clay, 5 to 12 percent slopes	1,900	0.3
83	Wilson clay loam, 0 to 1 percent slopes	8,850	1.4
84	Wilson clay loam, 1 to 3 percent slopes	13,070	2.1
85	Wilson-Urban land complex, 0 to 2 percent slopes	2,880	0.5
	Water	30,272	4.9
	Total	613,120	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermudagrass
	Lb	Bu	Bu	Bu	AUM[1]
Aledo:					
21	---	---	---	---	---
Altoga:					
2	250	45	---	40	6.0
3	225	35	---	35	5.0
4	---	---	---	---	3.5
Aquilla:					
5	---	---	---	---	6.0
Arents:					
6	---	---	---	---	6.5
7	---	---	---	---	4.0
Aubrey:					
8	250	40	---	---	5.0
Bastrop:					
9	350	55	---	---	7.0
10	300	45	---	---	5.5
Birome:					
11	---	---	---	35	5.0
12	---	---	---	30	5.0
213	---	---	---	---	---
214	---	---	---	---	---
215	---	---	---	---	---
Bolar:					
16	---	40	---	40	5.0
17	---	35	---	35	5.0
Branyon:					
18	450	85	---	---	7.0
19	450	80	---	---	7.0
Bunyan:					
20	---	---	---	---	8.0
Burleson:					
21	400	85	---	---	7.0
22	450	80	---	---	7.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermudagrass
	Lb	Bu	Bu	Bu	AUM[1]
Callisburg:					
23	300	52	30	---	5.5
24	200	45	25	---	5.5
2 25	---	---	---	---	4.0
Crockett:					
26	400	58	25	---	7.5
27	350	54	25	---	7.5
2 28	---	---	---	---	---
Eddy:					
29	---	---	---	---	---
Energy:					
30	---	---	---	---	7.5
Ferris:					
2 31	300	45	---	---	5.5
2 32	---	---	---	---	4.5
Frio:					
33	450	75	---	60	7.0
34	---	---	---	---	7.0
Gasil:					
35	300	55	30	---	6.0
36	150	40	20	---	5.5
2 37	---	---	---	---	---
2 38	250	50	25	---	5.5
Gowen:					
39	500	70	30	---	8.0
40	---	---	---	---	8.0
Heiden:					
41	400	80	30	60	8.0
42	350	55	30	50	6.0
Houston Black:					
43	500	90	30	70	8.0
44	450	85	30	70	8.0
Justin:					
45	350	60	40	---	6.0
46	300	50	30	---	6.0
47	275	45	25	---	5.5

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermudagrass
	Lb	Bu	Bu	Bu	AUM[1]
Justin:					
[2]48	---	---	---	---	---
Kaufman:					
49	---	---	---	---	8.5
Konsil:					
50	300	55	30	---	6.0
51	150	40	20	---	5.0
Lewisville:					
52	500	80	---	70	7.5
53	375	70	---	60	7.0
Lindale:					
54	---	50	30	45	5.0
[2]55	---	---	---	---	---
Medlin:					
[2]56	---	---	---	---	4.0
[2]57	---	---	---	---	---
Mingo:					
58	250	40	25	40	5.0
Navo:					
59	300	55	40	60	8.0
60	300	50	30	55	8.0
61	---	50	30	50	7.0
[2]62	---	---	---	---	---
Ovan:					
63	400	90	30	---	8.0
64	---	---	---	---	8.0
Ponder:					
65	300	65	35	50	6.0
66	300	65	35	50	6.0
Sanger:					
67	300	50	30	---	6.5
68	250	40	20	---	6.0
[2]69	---	---	---	---	---
Seagoville:					
70	---	80	40	60	8.0
Silawa:					
71	300	45	---	---	6.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermuda-grass
	Lb	Bu	Bu	Bu	AUM[1]
Silstid:					
72	---	30	---	---	5.0
[2]73	---	---	---	---	---
Slidell:					
74	350	70	30	---	7.0
Somervell:					
[2]75	---	---	---	---	3.0
Speck:					
76	---	---	15	30	3.0
Stephen:					
77	150	45	---	40	3.5
Trinity:					
78	450	100	---	---	8.0
79	---	---	---	---	8.0
Vertel:					
80	300	30	20	---	5.0
81	---	25	15	---	4.0
82	---	---	---	---	3.0
Wilson:					
83	350	55	---	---	6.0
84	300	45	---	---	6.0
[2]85	---	---	---	---	---

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
I	1,510	---	---	---
II	225,038	177,638	47,400	---
III	180,200	160,060	13,610	6,530
IV	30,400	30,440	---	---
V	44,280	---	44,280	---
VI	84,490	34,850	450	49,190
VII	1,760	1,760	---	---
Total---	567,718	---	---	---

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Aledo:					
1[1]	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,000	Sideoats grama	10
		Unfavorable	1,800	Indiangrass	15
				Big bluestem	10
				Switchgrass	5
				Silver bluestem	5
				Hairy grama	5
				Hairy dropseed	5
				Texas wintergrass	5
				Other perennial forbs	5
				Other trees	5
Altoga:					
2, 3, 4	Clay Loam	Favorable	6,500	Little bluestem	35
		Normal	5,000	Big bluestem	20
		Unfavorable	3,800	Indiangrass	15
				Switchgrass	5
				Florida paspalum	5
				Virginia wildrye	5
				Sideoats grama	5
				Other perennial grasses	5
				Other perennial forbs	5
Aquilla:					
5	Deep Sand	Favorable	5,000	Little bluestem	35
		Normal	4,000	Indiangrass	15
		Unfavorable	3,000	Sand lovegrass	5
				Purpletop	5
				Silver bluestem	5
				Fringeleaf paspalum	5
				Greenbrier	5
				Big bluestem	5
				Switchgrass	5
				Other trees	10
				Other shrubs	5
Arents:					
6, 7	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Switchgrass	10
				Texas wintergrass	5
				Virginia wildrye	5
				Silver bluestem	5
				Sideoats grama	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other trees	5
Aubrey:					
8	Tight Sandy Loam	Favorable	4,500	Little bluestem	25
		Normal	2,500	Sideoats grama	25
		Unfavorable	1,500	Post oak	10
				Big bluestem	5
				Purpletop	5
				Panicum	5
				Blackjack oak	5
				Other perennial forbs	10
				Other perennial grasses	5
				Other trees	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bastrop:					
9, 10	Sandy Loam	Favorable	5,000	Little bluestem	50
		Normal	4,000	Indiangrass	10
		Unfavorable	2,000	Switchgrass	5
				Purpletop	5
				Sideoats grama	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Lindheimer hackberry	5
				Other perennial forbs	3
				Other annual forbs	2
Birome:					
11, 12	Sandy Loam	Favorable	6,000	Little bluestem	25
		Normal	4,500	Indiangrass	10
		Unfavorable	3,500	Post oak	10
				Purpletop	5
				Switchgrass	5
				Beaked panicum	5
				Scribner panicum	5
				Florida paspalum	5
				Canada wildrye	5
				Blackjack oak	5
				Greenbrier	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
[1]13:					
Birome part	Sandy Loam	Favorable	4,500	Little bluestem	25
		Normal	3,500	Indiangrass	10
		Unfavorable	2,000	Post oak	10
				Switchgrass	5
				Purpletop	5
				Beaked panicum	5
				Scribner panicum	5
				Sedge	5
				Blackjack oak	5
				Other trees	10
				Other perennial forbs	10
				Other perennial grasses	5
Rayex part	Sandstone Hills	Favorable	3,500	Little bluestem	25
		Normal	2,500	Purpletop	10
		Unfavorable	1,500	Indiangrass	10
				Post oak	10
				Beaked panicum	5
				Big bluestem	5
				Sand lovegrass	5
				Scribner panicum	5
				Blackjack oak	5
				Sedge	3
				Greenbrier	2
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
Aubrey part	Tight Sandy Loam	Favorable	4,500	Little bluestem	25
		Normal	2,500	Indiangrass	10
		Unfavorable	1,500	Panicum	10
				Post oak	10
				Switchgrass	5
				Purpletop	5
				Blackjack oak	5
				Sedge	5
				Other perennial forbs	10
				Other trees	10
				Other perennial grasses	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bolar:					
16, 17	Clay Loam	Favorable	5,500	Little bluestem	20
		Normal	4,500	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Branyon:					
18, 19	Blackland	Favorable	7,000	Little bluestem	50
		Normal	5,500	Indiangrass	13
		Unfavorable	3,500	Big bluestem	12
				Other perennial grasses	10
				Other perennial forbs	10
				Other trees	5
Bunyan:					
20	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas wintergrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5
Burleson:					
21, 22	Blackland	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Sideoats grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Tall dropseed	5
				Other perennial grasses	5
				Other perennial forbs	5
Callisburg:					
23, 24, 25	Sandy Loam	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,500	Switchgrass	10
				Sand lovegrass	5
				Other trees	15
				Other perennial grasses	5
				Other shrubs	5
				Other perennial forbs	5
Crockett:					
26, 27	Claypan Prairie	Favorable	6,000	Little bluestem	10
		Normal	4,500	Indiangrass	10
		Unfavorable	3,000	Virginia wildrye	10
				Florida paspalum	10
				Sideoats grama	10
				Texas wintergrass	10
				Silver bluestem	10
				Paspalum	10
				Big bluestem	5
				Other perennial forbs	5
				Other trees	5
				Other perennial grasses	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Eddy:					
29	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas wintergrass	5
				Silver bluestem	5
				Hairy grama	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other trees	5
Energy:					
30	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	3,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas wintergrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5
Ferris:					
[1]31:					
Ferris part	Eroded Blackland	Favorable	7,000	Little bluestem	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Switchgrass	5
				Florida paspalum	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Other perennial forbs	5
Heiden part	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
				Eastern gamagrass	2
				Switchgrass	2
				Sideoats grama	2
				Virginia wildrye	2
				Vine-mesquite	2
				Other perennial forbs	10
				Other trees	5
[1]32:					
Ferris part	Eroded Blackland	Favorable	6,000	Little bluestem	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Switchgrass	5
				Florida paspalum	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
[1]32:					
Heiden part	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
				Eastern gamagrass	2
				Switchgrass	2
				Sideoats grama	2
				Virginia wildrye	2
				Vine-mesquite	2
				Other perennial forbs	10
				Other trees	5
Frio:					
33, 34	Loamy Bottomland	Favorable	7,500	Big bluestem	10
		Normal	5,500	Little bluestem	10
		Unfavorable	4,000	Vine-mesquite	10
				Switchgrass	5
				Indiangrass	5
				Eastern gamagrass	5
				Texas wintergrass	5
				Plains lovegrass	5
				Canada wildrye	5
				Cane bluestem	5
				Southwestern bristlegrass	5
				Other trees	15
				Other perennial grasses	10
				Other perennial forbs	5
Gasil:					
35, 36	Sandy Loam	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,500	Beaked panicum	10
				Virginia wildrye	5
				Other trees	15
				Other perennial grasses	5
				Other shrubs	5
				Other perennial forbs	5
[1]38:					
Gasil part	Sandy Loam	Favorable	4,500	Little bluestem	45
		Normal	3,500	Indiangrass	10
		Unfavorable	2,000	Beaked panicum	10
				Virginia wildrye	5
				Other trees	15
				Other perennial grasses	5
				Other shrubs	5
				Other perennial forbs	5
Konsil part	Sandy Loam	Favorable	4,500	Little bluestem	45
		Normal	2,500	Indiangrass	10
		Unfavorable	2,000	Big bluestem	10
				Post oak	10
				Purpletop	5
				Sand lovegrass	5
				Blackjack oak	5
				Other perennial forbs	5
				Other perennial grasses	5
Gowen:					
39, 40	Loamy Bottomland	Favorable	8,000	Indiangrass	20
		Normal	5,500	Big bluestem	15
		Unfavorable	4,000	Little bluestem	15
				Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
				Vine-mesquite	5
				Texas wintergrass	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other shrubs	5
				Other trees	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Heiden:					
41, 42	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
				Eastern gamagrass	2
				Switchgrass	2
				Sideoats grama	2
				Virginia wildrye	2
				Vine-mesquite	2
				Other perennial forbs	10
				Other trees	5
Houston Black:					
43, 44	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Indiangrass	25
		Unfavorable	3,500	Switchgrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other shrubs	5
				Other annual forbs	5
Justin:					
45, 46, 47	Sandy Loam	Favorable	6,000	Little bluestem	50
		Normal	4,500	Indiangrass	10
		Unfavorable	3,500	Texas wintergrass	10
				Meadow dropseed	5
				Post oak	5
				Other trees	10
				Other perennial grasses	5
				Other annual grasses	5
Kaufman:					
49	Clayey Bottomland	Favorable	7,500	Virginia wildrye	15
		Normal	6,000	Sedge	10
		Unfavorable	4,000	Beaked panicum	10
				Eastern gamagrass	10
				American elm	10
				Canada wildrye	5
				Switchgrass	5
				Indiangrass	5
				Vine-mesquite	5
				Panicum	5
				Buffalograss	5
				Sugar hackberry	5
				Eastern cottonwood	5
				Trailing wildbean	3
				Tickclover	2
Konsil:					
50, 51	Sandy Loam	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,500	Big bluestem	10
				Post oak	10
				Purpletop	5
				Sand lovegrass	5
				Blackjack oak	5
				Other perennial forbs	5
				Other perennial grasses	5
Lewisville:					
52, 53	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,500	Indiangrass	15
		Unfavorable	3,500	Big bluestem	15
				Switchgrass	10
				Texas wintergrass	5
				Virginia wildrye	5
				Silver bluestem	5
				Meadow dropseed	5
				Buffalograss	5
				Sideoats grama	5
				Other perennial forbs	5
				Other trees	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lindale:					
54	Deep Redland	Favorable	6,000	Big bluestem	15
		Normal	5,000	Indiangrass	20
		Unfavorable	4,000	Little bluestem	20
				Sideoats grama	5
				Tall dropseed	5
				Silver bluestem	5
				Plains lovegrass	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other shrubs	5
Medlin:					
[1]56:					
Medlin part	Blackland	Favorable	6,000	Little bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Texas wintergrass	10
				Switchgrass	5
				Meadow dropseed	5
				Sideoats grama	5
				Buffalograss	5
				Other perennial grasses	5
				Other annual grasses	5
Sanger part	Blackland	Favorable	6,000	Little bluestem	45
		Normal	5,000	Big bluestem	10
		Unfavorable	3,000	Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Buffalograss	5
				Silver bluestem	5
				Other perennial forbs	10
				Other annual grasses	5
				Other perennial grasses	5
[1]57:					
Medlin part	Blackland	Favorable	6,000	Little bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Texas wintergrass	10
				Switchgrass	5
				Meadow dropseed	5
				Sideoats grama	5
				Buffalograss	5
				Other perennial grasses	5
				Other annual grasses	5
Sanger part	Blackland	Favorable	6,000	Little bluestem	45
		Normal	5,000	Big bluestem	10
		Unfavorable	3,000	Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Buffalograss	5
				Silver bluestem	5
				Other perennial forbs	10
				Other annual grasses	5
				Other perennial grasses	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Mingo:					
58	Deep Redland	Favorable	6,000	Big bluestem	20
		Normal	5,000	Little bluestem	20
		Unfavorable	4,000	Sideoats grama	10
				Meadow dropseed	10
				Indiangrass	10
				Texas wintergrass	5
				Silver bluestem	5
				Canada wildrye	5
				Other perennial grasses	5
				Other annual grasses	5
				Other shrubs	5
Navo:					
59, 60, 61	Claypan Prairie	Favorable	6,000	Little bluestem	50
		Normal	4,000	Big bluestem	15
		Unfavorable	3,500	Meadow dropseed	10
				Indiangrass	5
				Texas wintergrass	5
				Other perennial grasses	5
				Other annual grasses	5
				Other trees	5
Ovan:					
63, 64	Clayey Bottomland	Favorable	7,500	Little bluestem	40
		Normal	6,000	Canada wildrye	15
		Unfavorable	4,000	Big bluestem	10
				Purpletop	10
				Texas wintergrass	5
				American elm	5
				Pecan	5
				Other annual forbs	5
				Other trees	5
Ponder:					
65, 66	Claypan Prairie	Favorable	5,500	Little bluestem	50
		Normal	4,000	Big bluestem	15
		Unfavorable	2,000	Texas wintergrass	10
				Sideoats grama	5
				Meadow dropseed	5
				Buffalograss	5
				Other perennial grasses	5
				Other annual grasses	5
Sanger:					
67, 68	Blackland	Favorable	6,000	Little bluestem	45
		Normal	5,000	Big bluestem	10
		Unfavorable	3,000	Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Buffalograss	5
				Silver bluestem	5
				Other perennial forbs	10
				Other annual grasses	5
				Other perennial grasses	5
Seagoville:					
70	Clayey Bottomland	Favorable	7,500	Little bluestem	40
		Normal	6,000	Canada wildrye	15
		Unfavorable	4,000	Big bluestem	10
				Purpletop	10
				Texas wintergrass	5
				American elm	5
				Pecan	5
				Other annual forbs	5
				Other trees	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Silawa:					
71	Loamy Sand	Favorable	5,500	Little bluestem	50
		Normal	4,500	Indiangrass	10
		Unfavorable	3,000	Switchgrass	5
				Purpletop	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				American beautyberry	5
				Other perennial forbs	5
				Other annual grasses	5
Silstid:					
72	Sandy	Favorable	4,500	Little bluestem	50
		Normal	4,000	Indiangrass	10
		Unfavorable	2,000	Crinkleawn	5
				Purpletop	5
				Switchgrass	5
				Fringeleaf paspalum	5
				Post oak	5
				Blackjack oak	5
				Other annual grasses	5
				Other perennial forbs	5
Slidell:					
74	Blackland	Favorable	6,000	Little bluestem	45
		Normal	5,000	Big bluestem	10
		Unfavorable	3,000	Sideoats grama	5
				Texas wintergrass	5
				Meadow dropseed	5
				Buffalograss	5
				Silver bluestem	5
				Other perennial forbs	10
				Other annual grasses	5
				Other perennial grasses	5
Somervell:					
75	Clay Loam	Favorable	6,000	Little bluestem	40
		Normal	4,500	Sideoats grama	8
		Unfavorable	3,000	Tall grama	7
				Indiangrass	5
				Silver bluestem	5
				Tall dropseed	3
				Purple threeawn	2
				Slim tridens	2
				Fall witchgrass	2
				Hairy grama	1
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
				Other shrubs	4
Speck:					
76	Redland	Favorable	3,800	Little bluestem	25
		Normal	3,000	Sideoats grama	15
		Unfavorable	2,000	Texas wintergrass	10
				Tall dropseed	10
				Texas cupgrass	10
				Big bluestem	5
				Indiangrass	5
				Silver bluestem	5
				Live oak	5
				Post oak	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 6.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Stephen:					
77	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas wintergrass	5
				Silver bluestem	5
				Hairy grama	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other trees	5
Trinity:					
78, 79	Clayey Bottomland	Favorable	7,500	Virginia wildrye	15
		Normal	6,000	Sedge	15
		Unfavorable	4,000	Eastern gamagrass	10
				Switchgrass	10
				Indiangrass	10
				Giant cane	5
				Beaked panicum	5
				Panicum	5
				Other trees	20
				Other perennial forbs	5
Vertel:					
80, 81, 82	Eroded Blackland	Favorable	5,000	Little bluestem	40
		Normal	4,000	Big bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Virginia wildrye	5
				Vine-mesquite	5
				Texas wintergrass	5
				Other annual forbs	10
Wilson:					
83, 84	Claypan Prairie	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,000	Big bluestem	10
				Virginia wildrye	5
				Vine-mesquite	5
				Florida paspalum	5
				Sideoats grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial forbs	5

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aledo:				
1[1]	Moderate: too clayey.	Moderate: slope.	Severe: depth to rock, small stones.	Moderate: too clayey.
Altoga:				
2	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
3, 4	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Aquilla:				
5	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Moderate: too sandy.
Arents:				
6	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: too clayey.
7	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.
Aubrey:				
8	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Bastrop:				
9, 10	Slight	Slight	Moderate: slope.	Slight.
Birome:				
11, 12	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
1[1]3:				
Birome part	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Rayex part	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Aubrey part	Moderate: percs slowly.	Moderate: slope.	Severe: slope, large stones.	Moderate: large stones.
1[1]4:				
Birome part	Moderate: large stones.	Moderate: large stones.	Severe: slope, large stones.	Moderate: large stones.
Rayex part	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Urban land part.				
1[1]5:				
Birome part	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Urban land part.				

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Bolar: 16, 17	Slight	Slight	Moderate: small stones.	Slight.
Branyon: 18, 19	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Bunyan: 20	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Burleson: 21, 22	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Callisburg: 23, 24, [1]25	Slight	Slight	Moderate: percs slowly.	Slight.
Crockett: 26, 27	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
[1]28: Crockett part	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Urban land part.				
Eddy: 29	Moderate: slope, percs slowly.	Moderate: slope, small stones.	Severe: depth to rock, slope.	Moderate: small stones, too clayey.
Energy: 30	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Ferris: [1]31: Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Heiden part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
[1]32: Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Heiden part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Frio: 33	Severe: floods.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
34	Severe: floods.	Severe: too clayey.	Severe: floods.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Gasil: 35, 36	Slight	Slight	Moderate: slope.	Slight.
[1]37: Gasil part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
[1]38: Gasil part	Slight	Slight	Moderate: slope.	Slight.
Konsil part	Slight	Slight	Moderate: slope.	Slight.
Gowen: 39	Severe: floods.	Moderate: floods.	Moderate: too clayey, floods.	Moderate: too clayey.
40	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: too clayey floods.
Heiden: 41, 42	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Houston Black: 43, 44	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Justin: 45, 46, 47	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
[1]48: Justin part	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Urban land part.				
Kaufman: 49	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
Konsil: 50, 51	Slight	Slight	Moderate: slope.	Slight.
Lewisville: 52, 53	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Lindale: 54	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
[1]55: Lindale part	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
Urban land part.				

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Medlin:				
156:				
Medlin part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Sanger part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
157:				
Medlin part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey, large stones.	Severe: too clayey.
Sanger part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, large stones.	Severe: too clayey.
Mingo:				
58	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: depth to rock, too clayey.	Moderate: too clayey.
Navo:				
59, 60, 61	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
162:				
Navo part	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
Urban land part.				
Ovan:				
63	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
64	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
Ponder:				
65, 66	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Sanger:				
67, 68	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
169:				
Sanger part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Urban land part.				
Seagoville:				
70	Severe: too clayey, floods, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Silawa: 71	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Silstid: 72	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
[1]73: Silstid part	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Urban land part.				
Slidell: 74	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Somervell: [1]75	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
Speck: 76	Moderate: percs slowly.	Moderate: too clayey.	Severe: depth to rock.	Moderate: too clayey.
Stephen: 77	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
Trinity: 78	Severe: wetness, floods, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: too clayey.
79	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.
Vertel: 80, 81	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
82	Severe: too clayey, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey,	Severe: too clayey.
Wilson: 83, 84	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
[1]85: Wilson part	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Urban land part.				

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Aledo:									
11	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Poor.
Altoga:									
2, 3	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
4	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Aquilla:									
5	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Arents:									
6	Poor	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair.
7	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair	Poor	Fair	Fair.
Aubrey:									
8	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Fair.
Bastrop:									
9	Good	Fair	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
10	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Birome:									
11, 12	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]13:									
Birome part	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Poor	Very poor.	Good.
Rayex part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Aubrey part	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Fair.
[1]14:									
Birome part	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Poor	Very poor.	Good.
Rayex part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Urban land part.									
[1]15:									
Birome part	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Urban land part.									
Bolar:									
16	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Bolar:									
17	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Branyon:									
18, 19	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
Bunyan:									
20	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Burleson:									
21, 22	Good	Good	Poor	Poor	Very poor.	Very poor.	Fair	Very poor.	Poor.
Callisburg:									
23, 24, [1]25	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Crockett:									
26, 27	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
[1]28:									
Crockett part	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Urban land part.									
Eddy:									
29	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Poor.
Energy:									
30	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Ferris:									
[1]31:									
Ferris part	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Heiden part	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]32:									
Ferris part	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Heiden part	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Frio:									
33	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
34	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Gasil:									
35, 36	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
[1]37:									
Gasil part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Urban land part.									
[1]38:									
Gasil part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Gasil:									
Konsil part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Gowen:									
39	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
40	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Heiden:									
41	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.
42	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Houston Black:									
43, 44	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
Justin:									
45, 46	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
47	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]48:									
Justin part	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Urban land part.									
Kaufman:									
49	Poor	Poor	Fair	Fair	Poor	Good	Poor	Fair	---
Konsil:									
50, 51	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Lewisville:									
52, 53	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Lindale:									
54	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]55:									
Lindale part	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Urban land part.									
Medlin:									
[1]56:									
Medlin part	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Very poor.	Poor.
Sanger part	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Fair.
[1]57:									
Medlin part	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Medlin:									
1 57:									
Sanger part	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Mingo:									
58	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Navo:									
59, 60, 61	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
1 62:									
Navo part	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Urban land part.									
Ovan:									
63	Fair	Fair	Poor	Fair	Poor	Good	Fair	Fair	Fair.
64	Poor	Poor	Fair	Fair	Poor	Good	Poor	Fair	Fair.
Ponder:									
65, 66	Fair	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Sanger:									
67	Fair	Good	Poor	Poor	Poor	Very poor.	Fair	Very poor.	Poor.
68	Fair	Good	Poor	Poor	Very poor.	Very poor.	Fair	Very poor.	Poor.
1 69:									
Sanger part	Fair	Good	Poor	Poor	Poor	Very poor.	Fair	Very poor.	Poor.
Urban land part.									
Seagoville:									
70	Good	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Silawa:									
71	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Silstid:									
72	Poor	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
1 73:									
Silstid part	Poor	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Urban land part.									
Slidell:									
74	Good	Good	Fair	Fair	Poor	Very poor.	Good	Very poor.	Fair.
Somervell:									
1 75	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Speck:									
76	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Stephen:									
77	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Trinity:									
78	Fair	Good	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
79	Poor	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
Vertel:									
80, 81	Fair	Fair	Poor	Fair	Poor	Very poor.	Fair	Very poor.	Poor.
82	Poor	Fair	Poor	Fair	Poor	Very poor.	Poor	Very poor.	Poor.
Wilson:									
83, 84	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
[1]85:									
Wilson part	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
Urban land part.									

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aledo:					
[1]1	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Altoga:					
2, 3, 4	Moderate: too clayey.	Severe: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Aquilla:					
5	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: wetness.	Slight.
Arents:					
6	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
7	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Aubrey:					
8	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell, low strength.	Severe: low strength.
Bastrop:					
9	Slight	Slight	Slight	Slight	Moderate: low strength.
10	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Birome:					
11, 12	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, depth to rock.	Severe: low strength.
[1]13:					
Birome part	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Severe: slope.	Severe: low strength.
Rayex part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Aubrey part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, depth to rock, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell,
[1]14:					
Birome part	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock, large stones.	Severe: low strength.
Rayex part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Urban land part.					
[1]15:					
Birome part	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, depth to rock.	Severe: low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Birome: Urban land part.					
Bolar:					
16	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
17	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Branyon:					
18, 19	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Bunyan:					
20	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Burleson:					
21, 22	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
Callisburg:					
23, 24, [1]25	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Crockett:					
26, 27	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, corrosive, low strength.	Severe: shrink-swell, low strength.
[1]28:					
Crockett part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, corrosive, low strength.	Severe: shrink-swell, low strength.
Urban land part.					
Eddy:					
29	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
Energy:					
30	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Ferris:					
[1]31:					
Ferris part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Heiden part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
[1]32:					
Ferris part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Heiden part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Frio:					
33	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
34	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Gasil:					
35, 36	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
[1]37:					
Gasil part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Urban land part.					
[1]38:					
Gasil part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Konsil part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Gowen:					
39	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: shrink-swell, floods.
40	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Heiden:					
41, 42	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Houston Black:					
43, 44	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Justin:					
45, 46, 47	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
[1]48:					
Justin part	Slight	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
Urban land part.					
Kaufman:					
49	Severe: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Konsil:					
50, 51	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
Lewisville:					
52, 53	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Lindale:					
54	Severe: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
[1]55:					
Lindale part	Severe: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Urban land part.					
Medlin:					
[1]56:					
Medlin part	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Sanger part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]57:					
Medlin part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
Sanger part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Mingo:					
58	Severe: depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Navo:					
59, 60, 61	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
[1]62:					
Navo part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Urban land part.					
Ovan:					
63	Severe: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
64	Severe: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Ponder:					
65, 66	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Sanger:					
67, 68	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]69:					
Sanger part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sanger: Urban land part.					
Seagoville: 70	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Silawa: 71	Slight	Slight	Slight	Slight	Moderate: low strength.
Silstid: 72	Moderate: cutbanks cave.	Slight	Slight	Slight	Slight.
[1]73: Silstid part	Moderate: cutbanks cave.	Slight	Slight	Slight	Slight.
Urban land part.					
Slidell: 74	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Somervell: [1]75	Severe: depth to rock, small stones.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Speck: 76	Severe: depth to rock.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: depth to rock, shrink-swell.
Stephen: 77	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Trinity: 78.					
79	Severe: wetness, floods, too clayey.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell.
Vertel: 80, 81, 82	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Wilson: 83, 84	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]85: Wilson part	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land part.					

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 10.--SANITARY FACILITIES

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aledo:					
[1]1	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones.
Altoga:					
2, 3	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
4	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
Aquilla:					
5	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Severe: seepage, wetness.	Fair: too sandy.
Arents:					
6	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
7	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Aubrey:					
8	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Bastrop:					
9, 10	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Birome:					
11, 12	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
[1]13:					
Birome part	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, large stones.
Rayex part	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, large stones.
Aubrey part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
[1]14:					
Birome part	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones.
Rayex part	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, large stones.
Urban land part.					
[1]15:					
Birome part	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Birome: Urban land part.					
Bolar: 16, 17	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Branyon: 18	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
19	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Bunyan: 20	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Burleson: 21	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
22	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Callisburg: 23, 24, [1]25	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Crockett: 26	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
27	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
[1]28: Crockett part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Urban land part.					
Eddy: 29	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Energy: 30	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Ferris: [1]31: Ferris part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Heiden part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
[1]32: Ferris part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Heiden part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Frio: 33	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Frio:					
34	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
Gasil:					
35, 36	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
[1]37:					
Gasil part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Urban land part.					
[1]38:					
Gasil part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Konsil part	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Gowen:					
39	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
40	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Heiden:					
41, 42	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Houston Black:					
43	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
44	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Justin:					
45	Severe: percs slowly.	Slight	Slight	Slight	Good.
46, 47	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
[1]48:					
Justin part	Severe: percs slowly.	Slight	Slight	Slight	Good.
Urban land part.					
Kaufman:					
49	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey, wetness.	Severe: floods.	Poor: too clayey, wetness.
Konsil:					
50, 51	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Lewisville:					
52, 53	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lindale:					
54	Severe: percs slowly.	Moderate: slope, small stones.	Severe: too clayey, small stones.	Slight	Poor: thin layer, too clayey.
155:					
Lindale part	Severe: percs slowly.	Moderate: slope, small stones.	Severe: too clayey, small stones.	Slight	Poor: thin layer, too clayey.
Urban land part.					
Medlin:					
156:					
Medlin part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Sanger part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
157:					
Medlin part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, large stones.
Sanger part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, large stones.
Mingo:					
58	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: too clayey.
Navo:					
59	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
60, 61	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
162:					
Navo part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Urban land part.					
Ovan:					
63	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
64	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Ponder:					
65	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
66	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Sanger:					
67, 68	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
169:					
Sanger part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Sanger: Urban land part.					
Seagoville: 70	Severe: floods, percs slowly.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods.	Poor: too clayey.
Silawa: 71	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Silstid: 72	Slight	Moderate: seepage, slope.	Slight	Slight	Poor: too sandy.
[1]73: Silstid part	Slight	Moderate: seepage, slope.	Slight	Slight	Poor: too sandy.
Urban land part.					
Slidell: 74	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Somervell: [1]75	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: small stones.
Speck: 76	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
Stephen: 77	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Trinity: 78	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: too clayey, wetness, floods.	Severe: wetness, floods.	Poor: too clayey.
79	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
Vertel: 80, 81	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
82	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Wilson: 83	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
84	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
[1]85: Wilson part	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
Urban land part.					

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aledo:				
[1]1	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Altoga:				
2, 3, 4	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Aquilla:				
5	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Arents:				
6	Fair: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
7	Fair: shrink-swell, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Aubrey:				
8	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Bastrop:				
9, 10	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Birome:				
11, 12	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
[1]13:				
Birome part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Rayex part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Aubrey part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
[1]14:				
Birome part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Rayex part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Urban land part.				
[1]15:				
Birome part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Urban land part.				

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bolar: 16, 17	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Branyon: 18, 19	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Bunyan: 20	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Burleson: 21, 22	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Callisburg: 23, 24, [1]25	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Crockett: 26, 27	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
[1]28: Crockett part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Urban land part.				
Eddy: 29	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Energy: 30	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ferris: [1]31: Ferris part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Heiden part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]32: Ferris part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Heiden part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Frio: 33, 34	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Gasil: 35, 36	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]37: Gasil part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gasil: Urban land part.				
[1]38: Gasil part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Konsil part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Gowen: 39, 40	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Heiden: 41, 42	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Houston Black: 43, 44	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Justin: 45, 46, 47	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]48: Justin part	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land part.				
Kaufman: 49	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Konsil: 50, 51	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Lewisville: 52, 53	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lindale: 54	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
[1]55: Lindale part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Urban land part.				
Medlin: [1]56: Medlin part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Sanger part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Medlin:				
1 57:				
Medlin part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
Sanger part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
Mingo:				
58	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer.
Navo:				
59, 60, 61	Poor: shrink-swell, low strengh.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
1 62:				
Navo part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Ovan:				
63, 64	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Ponder:				
65, 66	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Sanger:				
67, 68	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
1 69:				
Sanger part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Seagoville:				
70	Poor: shrink-swell.	Fair: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Silawa:				
71	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Silstid:				
72	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
1 73:				
Silstid part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land part.				
Slidell:				
74	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Somervell: [1]75	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
Speck: 76	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim.
Stephen: 77	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Trinity: 78, 79	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Vertel: 80, 81, 82	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Wilson: 83, 84	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]85: Wilson part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Aledo:						
[1]1	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Altoga:						
2, 3, 4	Moderate: seepage.	Moderate: unstable fill.	Not needed	Complex slope, erodes easily.	Favorable	Favorable.
Aquilla:						
5	Severe: seepage.	Moderate: piping, unstable fill.	Complex slope	Fast intake, droughty.	Piping, erodes easily.	Droughty, erodes easily, complex slope.
Arents:						
6	Severe: seepage.	Moderate: low strength.	Floods	Floods	Complex slope	Favorable.
7	Severe: seepage.	Moderate: low strength.	Slope	Slope	Slope	Slope.
Aubrey:						
8	Slight	Moderate: compressible.	Not needed	Slow intake	Favorable	Favorable.
Bastrop:						
9, 10	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.
Birome:						
11, 12	Severe: depth to rock.	Moderate: thin layer.	Not needed	Erodes easily, complex slope.	Erodes easily	Favorable.
[1]13:						
Birome part	Severe: depth to rock.	Severe: large stones.	Not needed	Complex slope, large stones.	Slope, large stones.	Slope, large stones.
Rayex part	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, droughty.	Depth to rock, rooting depth.	Rooting depth, droughty.
Aubrey part	Slight	Moderate: compressible.	Not needed	Slow intake	Large stones	Large stones.
[1]14:						
Birome part	Severe: depth to rock.	Severe: large stones.	Not needed	Complex slope, large stones.	Large stones	Large stones.
Rayex part	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, droughty.	Depth to rock, rooting depth.	Rooting depth, droughty.
Urban land part.						
[1]15:						
Birome part	Severe: depth to rock.	Moderate: thin layer.	Not needed	Erodes easily, complex slope.	Erodes easily	Favorable.
Urban land part.						
Bolar:						
16, 17	Severe: seepage.	Moderate: thin layer.	Not needed	Excess lime	Favorable	Favorable.
Branyon:						
18, 19	Slight	Moderate: compressible, piping.	Percs slowly, cutbanks cave.	Percs slowly	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Bunyan:						
20	Moderate: seepage.	Moderate: piping.	Not needed	Floods	Not needed	Favorable.
Burleson:						
21, 22	Slight	Moderate: unstable fill, hard to pack.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Callisburg:						
23, 24, [1]25	Moderate: seepage.	Moderate: compressible, piping.	Not needed	Slow intake	Erodes easily	Percs slowly, erodes easily.
Crockett:						
26, 27	Slight	Moderate: unstable fill, compressible.	Not needed	Percs slowly, rooting depth, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
[1]28:						
Crockett part	Slight	Moderate: unstable fill, compressible.	Not needed	Percs slowly, rooting depth, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Urban land part.						
Eddy:						
29	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Energy:						
30	Severe: seepage.	Moderate: piping.	Not needed	Floods	Floods	Floods.
Ferris:						
[1]31:						
Ferris part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slow intake.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Heiden part	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
[1]32:						
Ferris part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slow intake.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Heiden part	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Slow intake, slope.	Slope	Percs slowly, slope.
Frio:						
33	Moderate: seepage.	Moderate: compressible.	Not needed	Floods	Favorable	Favorable.
34	Moderate: seepage.	Moderate: compressible.	Not needed	Floods	Favorable	Favorable.
Gasil:						
35, 36	Moderate: seepage.	Slight	Not needed	Erodes easily	Erodes easily	Erodes easily.
[1]37:						
Gasil part	Moderate: seepage.	Slight	Not needed	Erodes easily	Erodes easily	Erodes easily.
Urban land part.						
[1]38:						
Gasil part	Moderate: seepage.	Slight	Not needed	Erodes easily	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Gasil:						
Konsil part-----	Moderate: seepage.	Moderate: piping.	Not needed-----	Erodes easily	Favorable------	Favorable.
Gowen:						
39----------	Moderate: seepage.	Moderate: compressible.	Not needed-----	Favorable------	Favorable------	Favorable.
40----------	Moderate: seepage.	Moderate: compressible.	Not needed-----	Floods---------	Wetness--------	Favorable.
Heiden:						
41, 42----------	Slight---------	Moderate: unstable fill, shrink-swell.	Not needed-----	Slow intake----	Percs slowly---	Percs slowly.
Houston Black:						
43, 44----------	Slight---------	Moderate: compressible, unstable fill.	Percs slowly---	Slow intake----	Percs slowly---	Percs slowly.
Justin:						
45, 46, 47-------	Moderate: seepage.	Moderate: compressible.	Not needed-----	Favorable------	Favorable------	Favorable.
[1]48:						
Justin part-----	Moderate: seepage.	Moderate: compressible.	Not needed-----	Favorable------	Favorable------	Favorable.
Urban land part.						
Kaufman:						
49----------	Slight---------	Moderate: low strength.	Floods, percs slowly, wetness.	Slow intake----	Percs slowly---	Percs slowly.
Konsil:						
50, 51----------	Moderate: seepage.	Moderate: piping.	Not needed-----	Erodes easily	Favorable------	Favorable.
Lewisville:						
52, 53----------	Moderate: seepage.	Moderate: unstable fill.	Favorable------	Favorable------	Favorable------	Favorable.
Lindale:						
54----------	Slight---------	Moderate: low strength.	Not needed-----	Slow intake----	Favorable------	Percs slowly.
[1]55:						
Lindale part----	Slight---------	Moderate: low strength.	Not needed-----	Slow intake----	Favorable------	Percs slowly.
Urban land part.						
Medlin:						
[1]56:						
Medlin part-----	Slight---------	Moderate: unstable fill.	Not needed-----	Percs slowly, slope.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Sanger part-----	Slight---------	Moderate: unstable fill, compressible.	Slope, percs slowly.	Slow intake, slope.	Slope, percs slowly.	Percs slowly, slope.
[1]57:						
Medlin part-----	Slight---------	Moderate: unstable fill, low strength.	Not needed-----	Slow intake, slope.	Large stones, slope.	Large stones, slope.
Sanger part-----	Slight---------	Moderate: unstable fill, low strength.	Not needed-----	Slow intake, slope.	Large stones, slope, percs slowly.	Percs slowly, slope, large stones.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Mingo: 58	Severe: depth to rock.	Moderate: piping, thin layer.	Not needed	Rooting depth, slow intake.	Rooting depth, percs slowly.	Favorable.
Navo: 59, 60, 61	Slight	Moderate: unstable fill.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
[1]62: Navo part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Urban land part.						
Ovan: 63, 64	Slight	Moderate: low strength.	Not needed	Slow intake	Percs slowly	Percs slowly.
Ponder: 65, 66	Slight	Moderate: compressible.	Not needed	Percs slowly, slow intake.	Percs slowly	Percs slowly.
Sanger: 67, 68	Slight	Moderate: unstable fill, compressible.	Slope, percs slowly.	Slow intake	Percs slowly	Percs slowly, slope.
[1]69: Sanger part	Slight	Moderate: unstable fill, compressible.	Slope, percs slowly.	Slow intake	Percs slowly	Percs slowly, slope.
Urban land part.						
Seagoville: 70	Severe: seepage.	Moderate: unstable fill.	Not needed	Slow intake, floods.	Not needed	Percs slowly.
Silawa: 71	Severe: seepage.	Moderate: piping, erodes easily.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Silstid: 72	Moderate: seepage.	Moderate: piping.	Not needed	Erodes easily, seepage.	Too sandy	Erodes easily.
[1]73: Silstid part	Moderate: seepage.	Moderate: piping.	Not needed	Erodes easily, seepage.	Too sandy	Erodes easily.
Urban land part.						
Slidell: 74	Slight	Moderate: compressible, unstable fill.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Somervell: [1]75	Severe: seepage.	Moderate: thin layer.	Not needed	Excess lime, droughty.	Complex slope	Droughty.
Speck: 76	Severe: depth to rock.	Severe: thin layer, low strength.	Not needed	Rooting depth	Depth to rock, rooting depth.	Rooting depth.
Stephen: 77	Severe: depth to rock.	Severe: thin layer.	Not needed	Droughty, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Trinity:						
78	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Percs slowly, wetness.	Floods, wetness, percs slowly.	Wetness, percs slowly.
79	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Percs slowly, floods, wetness.	Floods, wetness, percs slowly.	Floods, wetness, percs slowly.
Vertel:						
80, 81, 82	Slight	Moderate: compressible, unstable fill.	Not needed	Percs slowly, slope.	Percs slowly	Percs slowly.
Wilson:						
83, 84	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly, slow intake.	Percs slowly	Percs slowly.
[1]85:						
Wilson part	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly, slow intake.	Percs slowly	Percs slowly.
Urban land part.						

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.--POTENTIAL FOR URBANIZATION

Soil name and map symbol	Elements of urbanization				Potential for urbanization	Major limitations
	Dwellings	Streets	Excavations	Uncoated steel pipe		
Aledo:						
[1]1	Medium	Medium	Medium	Medium	Medium	Depth to rock, shrink-swell.
Altoga:						
2, 3, 4	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Aquilla:						
5	High	High	High	High	High	Wetness.
Arents:						
6, 7	Very low	Very low	Low	Low	Very low	Flooding, wetness, slope.
Aubrey:						
8	High	High	Medium	Low	High	Depth to rock, corrosivity, shrink-swell.
Bastrop:						
9, 10	High	High	High	Medium	High	Corrosivity.
Birome:						
11, 12, [1]15	High	High	High	Low	High	Corrosivity, depth to rock.
Birome-Rayex-Aubrey:						
[1]13	Medium	Medium	Low	Low	Medium	Slope, depth to rock, corrosivity.
Birome-Rayex-Urban land:						
[1]14	Medium	Medium	Medium	Low	Medium	Slope, depth to rock, corrosivity.
Bolar:						
16, 17	High	High	High	Low	High	Corrosivity, low strength, depth to rock.
Branyon:						
18, 19	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Bunyan:						
20	Very low	Very low	Low	Medium	Very low	Flooding, corrosivity.
Burleson:						
21, 22	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Callisburg:						
23, 24, [1]25	High	High	High	Low	High	Low strength, corrosivity, shrink-swell.

See footnote at end of table.

TABLE 13.--POTENTIAL FOR URBANIZATION--Continued

Soil name and map symbol	Elements of urbanization				Potential for urbanization	Major limitations
	Dwellings	Streets	Excavations	Uncoated steel pipe		
Crockett: 26, 27, [1]28	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Eddy: 29	Medium	Medium	Medium	Low	Medium	Depth to rock, slope.
Energy: 30	Very low	Very low	Low	Medium	Very low	Flooding.
Ferris-Heiden: [1]31, [1]32	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Frio: 33, 34	Very low	Very low	Low	Low	Very low	Flooding, corrosivity.
Gasil: 35, 36, [1]37	High	High	High	High	High	Shrink-swell.
Gasil, Konsil: [1]38	High	High	High	High	High	Shrink-swell, low strength.
Gowen: 39, 40	Very low	Very low	Low	Medium	Very low	Flooding.
Heiden: 41, 42	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Houston Black: 43, 44	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Justin: 45, 46, 47, [1]48	High	High	High	Medium	High	Low strength, shrink-swell.
Kaufman: 49	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell, corrosivity, cutbanks cave.
Konsil: 50, 51	High	High	High	High	High	Low strength, shrink-swell.
Lewisville: 52, 53	Medium	Medium	Medium	Low	Medium	Shrink-swell, corrosivity, low strength.
Lindale: 54, [1]55	High	High	Medium	Low	High	Corrosivity, shrink-swell, low strength.

See footnote at end of table.

TABLE 13.--POTENTIAL FOR URBANIZATION--Continued

Soil name and map symbol	Elements of urbanization				Potential for urbanization	Major limitations
	Dwellings	Streets	Excavations	Uncoated steel pipe		
Medlin-Sanger: [1]56, [1]57	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Mingo: 58	Medium	Medium	Medium	Low	Medium	Shrink-swell, corrosivity, low strength.
Navo: 59, 60, 61, [1]62	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Ovan: 63, 64	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell, low strength, cutbanks cave.
Ponder: 65, 66	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Sanger: 67, 68, [1]69	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Seagoville: 70	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell, low strength, cutbanks cave.
Silawa: 71	High	High	High	High	High	Corrosivity, cutbanks cave.
Silstid: 72, [1]73	High	High	High	High	High	Corrosivity, cutbanks cave.
Slidell: 74	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Somervell: [1]75	High	High	Medium	Low	High	Corrosivity, small stones.
Speck: 76	Medium	Medium	Low	Low	Medium	Depth to rock, low strength, shrink-swell.
Stephen: 77	Medium	Medium	Low	Low	Medium	Depth to rock, low strength, corrosivity.

See footnote at end of table.

TABLE 13.--POTENTIAL FOR URBANIZATION--Continued

Soil name and map symbol	Elements of urbanization				Potential for urbanization	Major limitations
	Dwellings	Streets	Excavations	Uncoated steel pipe		
Trinity: 78, 79	Very low	Very low	Very low	Low	Very low	Flooding, shrink-swell, wetness.
Vertel: 80, 81, 82	Low	Low	Low	Low	Low	Shrink-swell, low strength, cutbanks cave.
Wilson: 83, 84, [1]85	Medium	Medium	Medium	Low	Medium	Wetness, low strength, shrink-swell.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Aledo:											
1-----	0-4	Clay loam-------	CL, GC, GM, SC	A-4, A-6	0-20	65-95	60-90	55-90	40-70	30-40	10-20
	4-9	Very gravelly clay loam, very gravelly loam.	GC, GM, SC	A-2-4, A-2-6	5-30	35-55	30-50	25-50	15-35	30-40	10-20
	9-15	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Altoga:											
2, 3, 4-----	0-23	Silty clay------	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	80-99	35-51	20-31
	23-80	Silty clay, silty clay loam, clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	65-99	30-48	15-30
Aquilla:											
5-----	0-57	Loamy fine sand	SM, SP-SM	A-2-4	0	98-100	95-100	90-100	10-20	<21	NP-3
	57-80	Loamy fine sand, fine sandy loam, sandy loam.	SM, SP-SM	A-2-4	0	98-100	95-100	90-100	10-25	<21	NP-3
Arents:											
6, 7-----	0-80	----------	---	---	---	---	---	---	---	---	---
Aubrey:											
8-----	0-6	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	95-100	70-85	40-55	<25	NP-7
	6-27	Clay----------	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	51-75	40-60	20-35
	27-66	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Bastrop:											
9, 10-----	0-5	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	36-70	18-25	2-7
	5-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
Birome:											
11, 12-----	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	90-100	90-100	70-100	25-70	<30	NP-7
	6-27	Clay, sandy clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	51-75	35-55	15-35
	27-34	Clay, sandy clay, clay loam.	CL, SC	A-6, A-7	2-30	70-100	60-100	50-70	40-60	30-45	15-25
	34-60	Stratified unweathered bedrock to weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Birome:											
[1]13:											
Birome part------	0-8	Stony fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	2-15	75-90	75-90	55-90	30-55	<30	NP-7
	8-31	Clay, sandy clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	51-75	35-55	15-35
	31-60	Stratified unweathered bedrock to weathered bedrock.	---	---	---	---	---	---	---	---	---
Rayex part-------	0-7	Stony fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4	2-20	90-100	75-100	65-100	40-75	<30	NP-10
	7-15	Clay loam, sandy clay, clay.	CL, SC	A-6, A-7	0-10	80-100	80-100	80-100	48-80	30-45	15-25
	15-35	Variable--------	---	---	---	---	---	---	---	---	---
Aubrey part------	0-8	Stony fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4	1-5	95-100	95-100	70-85	40-55	<25	NP-7
	8-26	Clay------------	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	51-75	40-60	20-35
	26-66	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[1]14:											
Birome part------	0-8	Stony fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	2-15	75-90	75-90	55-90	30-55	<30	NP-7
	8-31	Clay, sandy clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	51-75	35-55	15-35
	31-60	Stratified unweathered bedrock to weathered bedrock.	---	---	---	---	---	---	---	---	---
Rayex part-------	0-7	Stony fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4	2-20	90-100	75-100	65-100	40-75	<30	NP-10
	7-15	Clay loam, sandy clay, clay.	CL, SC	A-6, A-7	0-10	80-100	80-100	80-100	48-80	30-45	15-25
	15-35	Variable--------	---	---	---	---	---	---	---	---	---
Urban land part.											
[1]15:											
Birome part------	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0-5	90-100	90-100	70-100	25-70	<30	NP-7
	6-27	Clay, sandy clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	51-75	35-55	15-35
	27-34	Clay, sandy clay, clay loam.	CL, SC	A-6, A-7	2-30	70-100	60-100	50-70	40-60	30-45	15-25
	34-60	Stratified unweathered bedrock to weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Birome:											
Urban land part.											
Bolar:											
16, 17	0-13	Clay loam	CL, SC	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-42	9-25
	13-34	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	34-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Branyon:											
18, 19	0-80	Clay	CH	A-7-6	0	95-100	75-100	75-100	75-100	60-80	35-55
Bunyan:											
20	0-21	Fine sandy loam	SM-SC, SC, CL, CL-ML	A-4, A-6	0	100	95-100	70-95	40-75	20-35	3-16
	21-66	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-4, A-6	0	100	95-100	80-100	40-95	20-40	8-25
Burleson:											
21, 22	0-46	Clay	CH, MH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-95	51-80	27-55
	46-80	Clay, silty clay	CH, MH	A-7-6, A-7-5	0-1	95-100	80-100	75-95	70-95	51-80	30-55
Callisburg:											
23, 24, [1]25	0-5	Fine sandy loam	CL, ML, SM, SC	A-4	0	95-100	90-100	75-100	36-75	<25	NP-8
	5-13	Sandy clay loam, sandy clay.	CL, SC	A-6, A-7	0	95-100	90-100	85-100	40-90	30-48	12-28
	13-80	Sandy clay, clay	CL	A-6, A-7	0	90-100	85-100	80-99	51-80	30-50	12-28
Crockett:											
26, 27	0-6	Fine sandy loam	SM, ML, CL, SC	A-2, A-4, A-6	0-2	95-100	95-100	90-100	35-95	15-35	3-15
	6-66	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-91	36-60	22-40
[1]28:											
Crockett part	0-6	Fine sandy loam	SM, ML, CL, SC	A-2, A-4, A-6	0-2	95-100	95-100	90-100	35-95	15-35	3-15
	6-66	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-91	36-60	22-40
Urban land part.											
Eddy:											
29	0-4	Gravelly clay loam.	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-8	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	8-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Energy:											
30----------	0-4	Fine sandy loam	CL, ML, SM, SC	A-4, A-6	0	95-100	95-100	80-100	40-75	<30	NP-16
	4-42	Stratified clay loam to fine sandy loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-100	40-95	20-40	8-25
	42-60	Stratified clay loam to fine sandy loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-100	40-95	20-40	8-25
Ferris:											
[1]31:											
Ferris part------	0-60	Clay----------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
Heiden part------	0-17	Clay----------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	17-80	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
[1]32:											
Ferris part------	0-60	Clay----------	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
Heiden part------	0-19	Clay----------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	19-80	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
Frio:											
33, 34----------	0-60	Silty clay------	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	60-95	35-52	20-34
Gasil:											
35, 36----------	0-7	Fine sandy loam	CL, ML, SC, SM	A-4, A-2-4	0	95-100	92-100	85-99	33-55	20-28	3-10
	7-80	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	92-100	85-100	36-71	22-40	7-22
[1]37:											
Gasil part-------	0-7	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	92-100	85-99	33-55	20-28	3-10
	7-75	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	92-100	85-100	36-71	22-40	7-22
Urban land part.											
[1]38:											
Gasil part-------	0-60	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	92-100	85-100	36-71	22-40	7-20
Konsil part------	0-60	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-6	0	90-100	90-99	85-95	40-60	28-40	11-20
Gowen:											
39, 40----------	0-45	Clay loam-------	CL	A-6, A-7-6	0	100	95-100	85-100	60-85	28-43	11-25
	45-65	Clay loam, loam	CL	A-4, A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	10-25
Heiden:											
41, 42----------	0-17	Clay----------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	17-80	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
Houston Black:											
43, 44----------	0-31	Clay----------	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
	31-80	Clay, silty clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Justin:											
45, 46, 47--------	0-12	Fine sandy loam	SC, CL	A-4, A-6	0	95-100	90-100	90-100	40-60	20-30	8-18
	12-17	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	95-100	90-100	90-100	40-75	30-40	15-25
	17-33	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	95-100	90-100	80-100	40-80	30-45	15-25
	33-80	Clay loam, clay	CL, CH	A-6, A-7-6	0	95-100	90-100	80-100	50-85	30-52	15-30
[1]48:											
Justin part------	0-12	Fine sandy loam	SC, CL	A-4, A-6	0	95-100	90-100	90-100	40-60	20-30	8-18
	12-17	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	95-100	90-100	90-100	40-75	30-40	15-25
	17-33	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	95-100	90-100	80-100	40-80	30-45	15-25
	33-80	Clay loam, clay	CL, CH	A-6, A-7-6	0	95-100	90-100	80-100	50-85	30-52	15-30
Urban land part.											
Kaufman:											
49----------	0-5	Clay----------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
	5-64	Clay----------	CH	A-7	0	100	100	95-100	90-100	76-96	49-70
Konsil:											
50, 51----------	0-12	Fine sandy loam	CL, ML, SC, SM	A-4	0	90-100	90-100	85-95	36-55	20-28	3-10
	12-66	Sandy clay loam, loam, fine sandy loam.	CL, SC	A-6	0	90-100	90-99	85-95	40-60	28-40	11-20
Lewisville:											
52, 53----------	0-15	Clay loam-------	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	15-37	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	37-74	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
Lindale:											
54----------	0-6	Clay loam-------	CL, SC	A-4, A-6	0	90-100	85-100	70-100	40-80	20-40	8-20
	6-32	Clay loam, clay	CL, CH	A-6, A-7	0	75-100	70-100	60-100	51-95	40-60	18-35
	32-43	Very gravelly clay.	GC	A-6, A-7, A-2-6, A-2-7	10-30	40-55	35-50	30-50	25-48	35-55	15-30
	43-65	Gravelly clay---	CL, CH, GC	A-6, A-7	0-10	60-90	55-85	50-85	40-80	35-55	15-30
[1]55:											
Lindale part-----	0-6	Clay loam-------	CL, SC	A-4, A-6	0	90-100	85-100	70-100	40-80	20-40	8-20
	6-32	Clay loam, clay	CL, CH	A-6, A-7	0	75-100	70-100	60-100	51-95	40-60	18-35
	32-43	Very gravelly clay.	GC	A-6, A-7, A-2-6, A-2-7	10-30	40-55	35-50	30-50	25-48	35-55	15-30
	43-65	Gravelly clay---	CL, CH, GC	A-6, A-7	0-10	60-90	55-85	50-85	40-80	35-55	15-30
Urban land part.											
Medlin:											
[1]56:											
Medlin part------	0-30	Clay----------	CH, CL	A-7	0	95-100	95-100	95-100	80-95	48-70	25-45
	30-70	Clay, silty clay	CL, CH	A-7, A-6	0	95-100	95-100	95-100	80-95	35-55	15-35

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Medlin:											
1 56:											
Sanger part------	0-38	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	80-95	51-70	28-42
	38-55	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-60	20-36
	55-90	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-55	20-35
1 57:											
Medlin part------	0-26	Stony clay------	CH, CL	A-7	2-15	90-100	90-100	90-100	75-95	48-70	25-45
	26-70	Clay, silty clay	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-55	15-35
Sanger part------	0-11	Stony clay------	CH	A-7-6	2-20	90-100	90-100	85-100	75-95	51-70	28-42
	11-23	Clay, silty clay	CH, CL	A-7-6, A-6	0	90-100	90-100	75-100	70-99	40-60	20-36
	23-60	Clay, silty clay	CH, CL	A-7-6, A-6	0	90-100	90-100	85-100	80-100	40-55	20-35
Mingo:											
58----------	0-11	Clay loam-------	CL	A-6, A-4, A-7	0	75-100	75-100	70-100	60-85	25-45	8-25
	11-29	Clay, clay loam	CH, CL	A-7	0	80-100	75-100	75-100	65-90	42-65	22-40
	29-33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Navo:											
59, 60, 61--------	0-5	Clay loam-------	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	25-48	11-25
	5-80	Clay, clay loam	CL, CH	A-7-6, A-6	0	95-100	95-100	90-100	60-90	40-65	20-45
1 62:											
Navo part--------	0-5	Clay loam-------	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	25-48	11-25
	5-80	Clay, clay loam	CL, CH	A-7-6, A-6	0	95-100	95-100	90-100	60-90	40-65	20-45
Urban land part.											
Ovan:											
63, 64----------	0-80	Clay----------	CL, CH	A-7-6	0	100	100	90-100	85-100	48-70	25-45
Ponder:											
65, 66----------	0-7	Loam----------	CL, SC	A-6, A-4	0	95-100	95-100	90-100	45-75	20-35	8-20
	7-16	Clay----------	CH, CL	A-7	0	95-100	95-100	95-100	75-95	43-65	25-45
	16-80	Clay, silty clay	CH, CL	A-7	0	95-100	95-100	95-100	75-95	43-65	25-45
Sanger:											
67, 68----------	0-38	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	80-95	51-70	28-42
	38-55	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-60	20-36
	55-80	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-55	20-35
1 69:											
Sanger part------	0-30	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	80-95	51-70	28-42
	30-55	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-60	20-36
	55-90	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-55	20-35
Urban land part.											
Seagoville:											
70----------	0-28	Clay----------	CH, CL	A-7-6	0	100	100	90-100	85-100	48-70	25-45
	28-37	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	70-90	40-60	20-35	8-20
	37-80	Loamy sand------	SM, SM-SC, SC	A-4, A-2-4, A-1	0	100	100	50-75	15-45	<30	NP-10

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Silawa:											
71	0-14	Loamy fine sand	SM, SM-SC	A-2-4	0	80-100	80-100	70-100	15-35	<25	NP-4
	14-39	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	80-100	80-100	80-100	35-60	25-40	8-18
	39-56	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-2	45-100	45-100	38-100	18-60	21-34	4-14
	56-60	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	45-100	45-100	38-100	12-40	<26	NP-7
Silstid:											
72	0-30	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	10-25	<25	NP-3
	30-72	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
[1]73:											
Silstid part	0-30	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	10-25	<25	NP-3
	30-72	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
Urban land part.											
Slidell:											
74	0-32	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	51-68	28-42
	32-80	Silty clay, clay	CH, CL	A-7-6, A-6	0	95-100	95-100	85-100	75-100	40-60	20-38
Somervell:											
[1]75	0-5	Gravelly loam	GC, GP-GC, CL, SC	A-6, A-2-6	0-35	15-80	10-75	8-75	6-60	25-40	11-25
	5-27	Very gravelly clay loam, very gravelly loam.	GC, GP-GC	A-6, A-2-6	0-35	15-50	10-50	8-50	6-40	25-40	11-25
	27-35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Speck:											
76	0-7	Clay loam	CL	A-6, A-7-6	0	90-100	90-100	80-95	70-90	30-45	15-25
	7-15	Clay, clay loam	CL, CH	A-7-6	0	85-100	80-100	70-100	55-95	45-65	25-40
	15-18	Indurated, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Stephen:											
77	0-8	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	8-14	Variable	---	---	---	---	---	---	---	---	---
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Trinity:											
78, 79	0-60	Clay	CH	A-7	0	100	98-100	85-100	80-99	55-90	30-60
Vertel:											
80, 81, 82	0-6	Clay	CH	A-7-6	0	95-100	95-100	90-100	90-100	60-85	40-60
	6-33	Clay	CH	A-7-6	0	95-100	95-100	90-100	85-100	60-85	40-60
	33-66	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wilson:											
83, 84	0-5	Clay loam	CL	A-4, A-6	0	95-100	85-100	80-100	60-96	25-36	10-20
	5-43	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	40-55	21-35
	43-64	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
[1]85:											
Wilson part	0-5	Clay loam	CL	A-4, A-6	0	95-100	85-100	80-100	60-96	25-36	10-20
	5-43	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	40-55	21-35
	43-64	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
Urban land part.											

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Aledo:									
[1]1	0-4	0.6-2.0	0.07-0.18	7.9-8.4	Moderate	Moderate	Low	0.32	1
	4-9	0.6-2.0	0.05-0.12	7.9-8.4	Low	Moderate	Low	---	
	9-15	---	---	---	---	---	---	---	
Altoga:									
2, 3, 4	0-23	0.6-2.0	0.15-0.18	7.9-8.4	High	High	Low	0.32	5
	23-80	0.6-2.0	0.15-0.18	7.9-8.4	Moderate	High	Low	0.32	
Aquilla:									
5	0-57	>20	0.05-0.10	5.6-7.8	Very low	Low	Low	0.17	5
	57-80	>20	0.07-0.12	5.6-7.8	Very low	Low	Low	0.17	
Arents:									
6, 7	0-80	---	---	---	---	---	---	---	---
Aubrey:									
8	0-6	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	High	0.32	3
	6-27	0.06-0.2	0.15-0.20	4.5-6.0	High	High	High	0.32	
	27-66	---	---	---	---	---	---	---	
Bastrop:									
9, 10	0-5	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	Low	0.24	5
	5-80	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32	
Birome:									
11, 12	0-6	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Moderate	0.37	2
	6-27	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28	
	27-34	0.6-2.0	0.12-0.18	5.1-6.0	Moderate	High	Moderate	0.28	
	34-60	---	---	---	---	---	---	---	
[1]13:									
Birome part	0-8	0.6-2.0	0.08-0.15	5.6-7.3	Low	Low	Moderate	0.32	2
	8-31	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28	
	31-60	---	---	---	---	---	---	---	
Rayex part	0-7	0.6-2.0	0.07-0.15	5.6-7.3	Low	Low	Low	0.37	1
	7-15	0.2-0.6	0.12-0.20	4.5-6.0	Moderate	High	Moderate	0.32	
	15-35	---	---	---	---	---	---	---	
Aubrey part	0-8	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	High	0.32	3
	8-26	0.06-0.2	0.15-0.20	4.5-6.0	High	High	High	0.32	
	26-66	---	---	---	---	---	---	---	
[1]14:									
Birome part	0-8	0.6-2.0	0.08-0.15	5.6-7.3	Low	Low	Moderate	0.32	2
	8-31	0.2-0.6	0.15-0.20	5.1-6.0	High	High	Moderate	0.28	
	31-60	---	---	---	---	---	---	---	
Rayex part	0-7	0.6-2.0	0.07-0.15	5.6-7.3	Low	Low	Low	0.37	1
	7-15	0.2-0.6	0.12-0.20	4.5-6.0	Moderate	High	Moderate	0.32	
	15-35	---	---	---	---	---	---	---	
Urban land part.									
[1]15:									
Birome part	0-6	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Moderate	0.37	2
	6-27	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28	
	27-34	0.6-2.0	0.12-0.18	5,1-6.0	Moderate	High	Moderate	0.28	
	34-60	---	---	---	---	---	---	---	
Urban land part.									

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Bolar:									
16, 17	0-13	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	2
	13-34	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	---	
	34-40	---	---	---	---	---	---	---	
Branyon:									
18, 19	0-80	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	5
Bunyan:									
20	0-21	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.43	5
	21-66	0.6-2.0	0.15-0.19	5.6-8.4	Low	Moderate	Low	0.43	
Burleson:									
21, 22	0-46	<0.06	0.12-0.18	5.6-8.4	High	High	Low	0.32	4
	46-80	<0.06	0.12-0.18	7.4-8.4	High	High	Low	---	
Callisburg:									
23, 24, [1]25	0-5	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Moderate	0.37	5
	5-13	0.2-0.6	0.14-0.20	5.1-7.3	Moderate	Moderate	Moderate	---	
	13-80	0.2-0.6	0.15-0.20	5.1-7.8	Moderate	High	Moderate	---	
Crockett:									
26, 27	0-6	0.6-2.0	0.11-0.20	5.6-7.3	Low	Moderate	Low	0.43	5
	6-66	<0.06	0.14-0.18	5.6-7.8	High	High	Low	0.32	
[1]28:									
Crockett part	0-6	0.6-2.0	0.11-0.20	5.6-7.3	Low	Moderate	Low	0.43	5
	6-66	<0.06	0.14-0.18	5.6-7.8	High	High	Low	0.32	
Urban land part.									
Eddy:									
29	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-8	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	8-20	---	---	---	---	---	---	---	
Energy:									
30	0-4	0.6-2.0	0.11-0.15	7.9-8.4	Low	Moderate	Low	0.28	5
	4-42	0.6-2.0	0.11-0.20	7.9-8.4	Low	Moderate	Low	0.28	
	42-60	0.6-2.0	0.11-0.20	7.9-8.4	Low	Moderate	Low	0.28	
Ferris:									
[1]31:									
Ferris part	0-60	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	4
Heiden part	0-17	<0.06	0.15-0.20	7.9-8.4	Very high	High	Low	0.32	5
	17-80	<0.06	0.12-0.20	7.9-8.4	Very high	High	Low	0.32	
[1]32:									
Ferris part	0-60	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	4
Heiden part	0-19	<0.06	0.15-0.20	7.9-8.4	Very high	High	Low	0.32	5
	19-80	<0.06	0.12-0.20	7.9-8.4	Very high	High	Low	0.32	
Frio:									
33, 34	0-60	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	High	Low	0.32	5
Gasil:									
35, 36	0-7	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.24	5
	7-80	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low	Moderate	0.32	
[1]37:									
Gasil part	0-7	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.24	5
	7-75	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low	Moderate	0.32	
Urban land part.									
[1]38:									
Gasil part	0-60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low	Moderate	0.32	---

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Gasil:									
Konsil part------	0-60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32	---
Gowen:									
39, 40----------	0-45	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.28	5
	45-65	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.28	
Heiden:									
41, 42----------	0-17	<0.06	0.15-0.20	7.9-8.4	Very high	High-----	Low------	0.32	5
	17-80	<0.06	0.12-0.20	7.9-8.4	Very high	High-----	Low------	0.32	
Houston Black:									
43, 44----------	0-31	<0.06	0.15-0.20	7.4-8.4	Very high	High-----	Low------	0.32	4
	31-80	<0.06	0.15-0.20	7.4-8.4	Very high	High-----	Low------	0.32	
Justin:									
45, 46, 47-------	0-12	0.6-2.0	0.12-0.17	6.1-7.3	Low-------	Low------	Low------	0.28	5
	12-17	0.2-0.6	0.14-0.20	6.1-7.3	Moderate	Moderate	Low------	0.28	
	17-33	0.2-0.6	0.14-0.17	6.1-7.8	Moderate	Moderate	Low------	0.28	
	33-80	0.2-0.6	0.14-0.17	6.1-8.4	Moderate	Moderate	Low------	0.28	
[1]48:									
Justin part------	0-12	0.6-2.0	0.12-0.17	6.1-7.3	Low-------	Low------	Low------	0.28	5
	12-17	0.2-0.6	0.14-0.20	6.1-7.3	Moderate	Moderate	Low------	0.28	
	17-33	0.2-0.6	0.14-0.17	6.1-7.8	Moderate	Moderate	Low------	0.28	
	33-80	0.2-0.6	0.14-0.17	6.1-8.4	Moderate	Moderate	Low------	0.28	
Urban land part.									
Kaufman:									
49----------	0-5	0.06-0.2	0.15-0.20	5.6-7.8	High------	High-----	Low------	0.32	5
	5-64	<0.06	0.15-0.18	5.6-7.8	Very high	High-----	Low------	0.32	
Konsil:									
50, 51----------	0-12	2.0-6.0	0.11-0.15	6.1-7.8	Low-------	Low------	Low------	0.24	5
	12-66	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	Low------	Moderate	0.32	
Lewisville:									
52, 53----------	0-15	0.6-2.0	0.16-0.20	7.9-8.4	High------	High-----	Low------	0.32	5
	15-37	0.6-2.0	0.14-0.18	7.9-8.4	High------	High-----	Low------	0.37	
	37-74	0.6-2.0	0.14-0.18	7.9-8.4	High------	High-----	Low------	---	
Lindale:									
54----------	0-6	0.2-0.6	0.12-0.20	6.1-8.4	Low-------	High-----	Low------	0.32	2
	6-32	0.06-0.2	0.10-0.20	6.1-8.4	Moderate	High-----	Low------	0.32	
	32-43	0.06-0.2	0.02-0.10	7.9-8.4	Moderate	High-----	Low------	0.28	
	43-65	0.06-0.2	0.06-0.15	7.9-8.4	Moderate	High-----	Low------	0.28	
[1]55:									
Lindale part-----	0-6	0.2-0.6	0.12-0.20	6.1-8.4	Low-------	High-----	Low------	0.32	2
	6-32	0.06-0.2	0.10-0.20	6.1-8.4	Moderate	High-----	Low------	0.32	
	32-43	0.06-0.2	0.02-0.10	7.9-8.4	Moderate	High-----	Low------	0.28	
	43-65	0.06-0.2	0.06-0.15	7.8-8.4	Moderate	High-----	Low------	0.28	
Urban land part.									
Medlin:									
[1]56:									
Medlin part------	0-30	<0.06	0.12-0.18	7.4-8.4	High------	High-----	Low------	0.32	4
	30-70	<0.06	0.12-0.18	7.4-8.4	High------	High-----	Low------	0.32	
Sanger part------	0-38	<0.06	0.12-0.18	7.4-8.4	High------	High-----	Low------	0.32	5
	38-55	<0.06	0.12-0.18	7.9-8.4	High------	High-----	Low------	0.32	
	55-90	<0.06	0.12-0.18	7.9-8.4	High------	High-----	Low------	0.32	
[1]57:									
Medlin part------	0-26	<0.06	0.10-0.18	7.4-8.4	High------	High-----	Low------	0.28	4
	26-70	<0.06	0.12-0.18	7.4-8.4	High------	High-----	Low------	0.32	
Sanger part------	0-11	<0.06	0.10-0.18	7.4-8.4	High------	High-----	Low------	0.28	5
	11-23	<0.06	0.12-0.18	7.9-8.4	High------	High-----	Low------	0.32	
	23-60	<0.06	0.12-0.18	7.9-8.4	High------	High-----	Low------	0.32	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Mingo:									
58	0-11	0.6-2.0	0.12-0.18	6.6-8.4	Moderate	High	Low	0.37	2
	11-29	<0.06	0.10-0.20	6.6-8.4	High	High	Low	0.32	
	29-33	---	---	---	---	---	---	---	
Navo:									
59, 60, 61	0-5	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High	Low	0.32	5
	5-80	<0.06	0.12-0.18	5.6-8.4	High	High	Low	0.32	
[1]62:									
Navo part	0-5	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High	Low	0.32	5
	5-80	<0.06	0.12-0.18	5.6-8.4	High	High	Low	0.32	
Urban land part.									
Ovan:									
63, 64	0-80	<0.06	0.15-0.20	7.9-8.4	High	High	Low	0.32	5
Ponder:									
65, 66	0-7	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.43	5
	7-16	<0.06	0.12-0.16	5.6-7.8	High	High	Low	0.32	
	16-80	<0.06	0.12-0.16	6.6-8.4	High	High	Low	0.32	
Sanger:									
67, 68	0-38	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32	5
	38-55	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
	55-90	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
[1]69:									
Sanger part	0-30	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32	5
	30-55	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
	55-80	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
Urban land part.									
Seagoville:									
70	0-28	<0.06	0.15-0.20	7.4-8.4	High	High	Low	0.37	5
	28-37	2.0-6.0	0.11-0.19	7.4-8.4	Low	High	Low	0.43	
	37-80	2.0-6.0	0.07-0.14	7.4-8.4	Low	Low	Low	0.28	
Silawa:									
71	0-14	6.0-20	0.07-0.11	5.6-6.5	Very low	Low	Moderate	0.17	5
	14-39	0.6-2.0	0.12-0.17	5.1-6.0	Low	Moderate	Moderate	0.32	
	39-56	2.0-6.0	0.08-0.15	5.1-6.5	Low	Low	Moderate	0.32	
	56-60	6.0-20	0.05-0.11	5.1-6.5	Very low	Low	Moderate	0.20	
Silstid:									
72	0-30	6.0-20	0.05-0.10	5.6-6.5	Low	Low	Moderate	0.20	5
	30-72	0.6-2.0	0.12-0.17	5.6-6.5	Low	Moderate	Moderate	0.24	
[1]73:									
Silstid part	0-30	6.0-20	0.05-0.10	5.6-6.5	Low	Low	Moderate	0.20	5
	30-72	0.6-2.0	0.12-0.17	5.6-6.5	Low	Moderate	Moderate	0.24	
Urban land part.									
Slidell:									
74	0-32	<0.06	0.15-0.20	7.4-8.4	High	High	Low	0.32	4
	32-80	<0.06	0.15-0.20	7.4-8.4	High	High	Low	0.32	
Somervell:									
[1]75	0-5	0.6-2.0	0.11-0.20	7.9-8.4	Low	High	Low	0.32	2
	5-27	0.6-2.0	0.03-0.13	7.9-8.4	Low	High	Low	0.10	
	27-35	---	---	---	---	---	---	---	

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Speck:									
76	0-7	0.2-0.6	0.15-0.20	6.1-7.8	Moderate	High	Low	0.32	1
	7-15	0.06-0.2	0.12-0.18	6.1-7.8	High	High	Low	0.32	
	15-18	---	---	---	---	---	---	---	
Stephen:									
77	0-8	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	High	Low	0.32	1
	8-14	---	---	---	---	---	---	---	
	14-20	---	---	---	---	---	---	---	
Trinity:									
78, 79	0-60	<0.06	0.15-0.20	7.4-8.4	Very high	High	Low	0.32	5
Vertel:									
80, 81, 82	0-6	<0.06	0.09-0.18	6.6-8.4	Very high	High	Low	0.37	3
	6-33	<0.06	0.10-0.18	6.6-8.4	Very high	High	Low	0.37	
	33-66	---	---	---	---	---	---	---	
Wilson:									
83, 84	0-5	0.2-0.6	0.15-0.20	5.6-7.8	Low	High	Low	0.43	5
	5-43	<0.06	0.14-0.20	5.6-7.8	High	High	Low	0.37	
	43-64	<0.06	0.12-0.15	6.6-8.4	High	High	Low	0.37	
[1]85:									
Wilson part	0-5	0.2-0.6	0.15-0.20	5.6-7.8	Low	High	Low	0.43	5
	5-43	<0.06	0.14-0.20	5.6-7.8	High	High	Low	0.37	
	43-64	<0.06	0.12-0.15	6.6-8.4	High	High	Low	0.37	
Urban land part.									

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definition of "flooding" in the Glossary explains terms such as "rare," "brief," "occasional," and "frequent". The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Aledo: [1]1	C	None	---	---	>6.0	---	---	8-20	Hard
Altoga: 2, 3, 4	C	None	---	---	>6.0	---	---	>60	---
Aquilla: 5	A	None	---	---	4.0-6.0	Perched	Dec-Mar	>60	---
Arents: 6, 7	---	Occasional	Long	Sep-May	>6.0	---	---	>60	---
Aubrey: 8	C	None	---	---	>6.0	---	---	20-40	Rippable
Bastrop: 9, 10	B	None	---	---	>6.0	---	---	>60	---
Birome: 11, 12	C	None	---	---	>6.0	---	---	20-40	Rippable
[1]13:									
Birome part	C	None	---	---	>6.0	---	---	20-40	Rippable
Rayex part	D	None	---	---	>6.0	---	---	10-20	Rippable
Aubrey part	C	None	---	---	>6.0	---	---	20-40	Rippable
[1]14:									
Birome part	C	None	---	---	>6.0	---	---	20-40	Rippable
Rayex part	D	None	---	---	>6.0	---	---	10-20	Rippable
Urban land part.									
[1]15:									
Birome part	C	None	---	---	>6.0	---	---	20-40	Rippable
Urban land part.									
Bolar: 16, 17	C	None	---	---	>6.0	---	---	20-40	Rippable
Branyon: 18, 19	D	None	---	---	>6.0	---	---	>60	---
Bunyan: 20	B	Frequent	Brief	May-Oct	>6.0	---	---	>60	---
Burleson: 21, 22	D	None	---	---	>6.0	---	---	>60	---
Callisburg: 23, 24, [1]25	C	None	---	---	>6.0	---	---	>60	---
Crockett: 26, 27	D	None	---	---	>6.0	---	---	>60	---
[1]28:									
Crockett part	D	None	---	---	>6.0	---	---	>60	---
Urban land part.									

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Eddy:									
29	C	None	---	---	>6.0	---	---	3-15	Rippable
Energy:									
30	B	Frequent	Brief	May-Oct	>6.0	---	---	>60	---
Ferris:									
[1]31:									
Ferris part	D	None	---	---	>6.0	---	---	>60	---
Heiden part	D	None	---	---	>6.0	---	---	>60	---
[1]32:									
Ferris part	D	None	---	---	>6.0	---	---	>60	---
Heiden part	D	None	---	---	>6.0	---	---	>60	---
Frio:									
33, 34	B	Frequent	Brief	May-Oct	>6.0	---	---	>60	---
Gasil:									
35, 36	B	None	---	---	>6.0	---	---	>60	---
[1]37:									
Gasil part	B	None	---	---	>6.0	---	---	>60	---
Urban land part.									
[1]38:									
Gasil part	B	None	---	---	>6.0	---	---	>60	---
Konsil part	B	None	---	---	>6.0	---	---	>60	---
Gowen:									
39	B	Occasional	Brief	May-Sep	>6.0	---	---	>60	---
40	B	Frequent	Brief	May-Sep	>6.0	---	---	>60	---
Heiden:									
41, 42	D	None	---	---	>6.0	---	---	>60	---
Houston Black:									
43, 44	D	None	---	---	>6.0	---	---	>60	---
Justin:									
45, 46, 47	B	None	---	---	>6.0	---	---	>60	---
[1]48:									
Justin part	B	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Kaufman:									
49	D	Frequent	Brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---
Konsil:									
50, 51	B	None	---	---	>6.0	---	---	>60	---
Lewisville:									
52, 53	B	None	---	---	>6.0	---	---	>60	---
Lindale:									
54	C	None	---	---	>6.0	---	---	>60	---
[1]55:									
Lindale part	C	None	---	---	>6.0	---	---	>60	---

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Lindale:									
Urban land part.									
Medlin:									
[1]56:									
Medlin part-----	D	None--------	---	---	>6.0	---	---	>60	---
Sanger part-----	D	None--------	---	---	>6.0	---	---	>60	---
[1]57:									
Medlin part-----	D	None--------	---	---	>6.0	---	---	>60	---
Sanger part-----	D	None--------	---	---	>6.0	---	---	>60	---
Mingo:									
58----------	C	None--------	---	---	>6.0	---	---	22-40	Hard
Navo:									
59, 60, 61-------	D	None--------	---	---	>6.0	---	---	>60	---
[1]62:									
Navo part-------	D	None--------	---	---	>6.0	---	---	>60	---
Urban land part.									
Ovan:									
63----------	D	Occasional--	Brief-----	Mar-Jun	>6.0	---	---	>60	---
64----------	D	Frequent----	Brief-----	Mar-Jun	>6.0	---	---	>60	---
Ponder:									
65, 66----------	D	None--------	---	---	>6.0	---	---	>60	---
Sanger:									
67, 68----------	D	None--------	---	---	>6.0	---	---	>60	---
[1]69:									
Sanger part-----	D	None--------	---	---	>6.0	---	---	>60	---
Urban land part.									
Seagoville:									
70----------	D	Common------	Very brief	Oct-Jun	>6.0	---	---	>60	---
Silawa:									
71----------	B	None--------	---	---	>6.0	---	---	>60	---
Silstid:									
72----------	A	None--------	---	---	>6.0	---	---	>60	---
[1]73:									
Silstid part----	A	None--------	---	---	>6.0	---	---	>60	---
Urban land part.									
Slidell:									
74----------	D	None--------	---	---	>6.0	---	---	>60	---
Somervell:									
[1]75----------	B	None--------	---	---	>6.0	---	---	20-40	Hard
Speck:									
76----------	D	None--------	---	---	>6.0	---	---	14-20	Hard
Stephen:									
77----------	C	None--------	---	---	>6.0	---	---	7-20	Rippable
Trinity:									
78----------	D	Occasional--	Brief-----	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Trinity:									
79	D	Frequent	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---
Vertel:									
80, 81, 82	D	None	---	---	>6.0	---	---	24-40	Rippable
Wilson:									
83, 84	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---
[1]85:									
Wilson part	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---
Urban land part.									

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 17.--ENGINEERING TEST DATA

[Tests performed by the Texas Highway Department in accordance with standard procedures of the American Association of State Highway and Transportation Officials]

Soil name and location	Depth	Shrinkage			Mechanical analysis[1]							Liquid limit[2]	Plasticity index	Classification	
		Lineal	Limit[2]	Ratio	Percentage passing sieve--				Percentage smaller than--					AASHTO[3]	Unified[4]
					No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm				
Branyon clay:															
From Little Elm, 0.9 mile south and west to Hackberry Park; 750 feet southeast of park entrance.	0-6	21.6	12	2.05	100	99	98	92	85	52	41	64	43	A-7-6(20)	CH
	6-56	22.2	11	2.06	100	100	99	94	88	58	46	66	45	A-7-6(20)	CH
	80-96	22.8	11	2.09	93	90	88	84	79	57	48	68	48	A-7-6(20)	CH
Callisburg fine sandy loam:															
From Denton, approximately 7 miles east on U.S. Highway 380 to Mosley Road, 0.6 mile south, 0.2 mile east, 1.2 miles south to cattleguard, 0.25 mile west into pasture.	0-5	3.2	17	1.77	100	99	99	58	44	11	7	22	5	A-4(5)	CL-ML
	13-32	14.1	12	1.99	100	100	99	75	69	41	37	41	27	A-7-6(15)	CL
	56-85	8.8	--	1.91	100	99	97	58	50	25	21	30	18	A-6(8)	CL
Gasil fine sandy loam:															
From Flower Mound Church, 2.0 miles west, 0.5 mile north, 1.5 miles west to aluminum gate, 200 feet north in pasture.	0-7	1.2	--	1.70	98	96	94	33	24	4	3	20	3	A-2-4	SM
	16-37	11.4	14	1.91	98	94	92	60	50	33	29	37	22	A-6(10)	CL
	85-90	8.5	15	1.84	99	99	99	84	67	28	23	32	17	A-6(11)	CL
Justin loam:															
From Flower Mound north of water tower, 0.2 mile east on Farm Road 1171, 0.7 mile north, and 400 feet east in wooded pasture.	0-18	6.4	--	1.83	100	100	100	51	45	23	16	28	14	A-6(5)	CL
	31-59	10.6	14	1.89	99	98	98	51	46	30	27	35	21	A-6(7)	CL
	59-86	10.6	14	1.88	99	98	98	50	43	28	25	36	22	A-6(7)	SC
Navo clay loam:															
From Flower Mound Church, 0.5 mile north on paved road, and 200 feet east in a meadow.	0-5	8.7	14	1.91	99	98	97	58	51	25	23	30	16	A-6(7)	CL
	10-22	14.8	10	2.03	99	98	95	69	62	38	33	41	28	A-7-6(14)	CL
	72-95	19.8	10	2.09	100	99	97	81	77	51	46	55	39	A-7-6(19)	CH
Ovan clay:															
From Navo, 0.8 mile south, 0.1 mile east, and 0.7 mile south.	6-66	19.4	12	1.99	100	100	100	96	90	57	48	57	40	A-7-6(20)	CH

See footnotes at end of table.

TABLE 17.--ENGINEERING TEST DATA--Continued

Soil name and location	Depth	Shrinkage			Mechanical analysis[1]							Liquid limit[2]	Plasticity index	Classification	
		Lineal	Limit[2]	Ratio	Percentage passing sieve--				Percentage smaller than--					AASHTO[3]	Unified[4]
					No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm				
Ponder clay loam:															
From Denton, 8 miles south on Interstate 35E to Crawford Road, 1.1 miles west, 0.3 mile south and west on private road, 320 feet south in range.	0-7	7.4	--	1.80	99	99	98	71	64	23	17	30	15	A-6(9)	CL
	7-16	17.6	13	1.97	100	100	99	83	78	51	46	52	33	A-7-6(18)	CH
	22-72	19.0	11	2.05	100	99	98	82	76	46	40	54	39	A-7-6(19)	CH
Sanger clay:															
From Denton, 8 miles south on Interstate 35E, 1.1 miles west on Crawford Road, 800 feet south in field.	7-38	18.6	11	2.05	100	96	92	85	78	49	34	52	35	A-7-6(18)	CH
	38-55	13.2	14	2.00	100	100	99	96	91	62	39	40	24	A-6(14)	CL
	55-69	15.3	15	1.93	99	99	98	94	89	64	45	49	32	A-7-6(18)	CL
Vertel clay:															
From Lewisville, 5 miles east to Farm Road 423, 3.7 miles north, and 300 feet west in a pasture.	0-6	24.7	11	2.03	100	100	100	99	95	82	68	77	51	A-7-6(20)	CH
	6-33	23.8	13	2.02	98	97	95	91	85	67	50	75	50	A-7-6(20)	CH
	33-66	22.8	14	1.91	98	97	95	91	80	62	48	77	50	A-7-6(20)	CH

[1] Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2] Test procedures may cause minor differences in shrinkage limit, liquid limit, and computed plasticity index.

[3] Based on the Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Haplustolls
Altoga	Fine-silty, carbonatic, thermic Typic Ustochrepts
Aquilla	Sandy, siliceous, thermic Psammentic Paleustalfs
Arents	Arents
Aubrey	Clayey, mixed, thermic Typic Haplustults
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Birome	Fine, mixed, thermic Ultic Paleustalfs
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Bunyan	Fine-loamy, mixed, nonacid, thermic Typic Ustifluvents
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Callisburg	Fine, mixed, thermic Udic Paleustalfs
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Eddy	Loamy-skeletal, carbonatic, thermic, shallow Typic Ustorthents
Energy	Fine-loamy, mixed (calcareous), thermic Typic Ustifluvents
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Frio	Fine, mixed, thermic Cumulic Haplustolls
Gasil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Justin	Fine-loamy, mixed, thermic Udic Paleustolls
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Konsil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Lewisville	Fine-silty, mixed, thermic Typic Calciustolls
Lindale	Fine, mixed, thermic Typic Haplustalfs
Medlin	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Mingo	Fine, mixed, thermic Pachic Argiustolls
Navo	Fine, montmorillonitic, thermic Udertic Paleustalfs
Ovan	Fine, montmorillonitic, thermic Udic Chromusterts
Ponder	Fine, montmorillonitic, thermic Udertic Paleustalfs
Rayex	Clayey, mixed, thermic, shallow Ultic Haplustalfs
Sanger	Fine, montmorillonitic, thermic Udic Chromusterts
Seagoville	Clayey over loamy, montmorillonitic, thermic Udic Chromusterts
Silawa	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Silstid	Loamy, siliceous, thermic Arenic Paleustalfs
Slidell	Fine, montmorillonitic, thermic Udic Pellusterts
Somervell	Loamy-skeletal, carbonatic, thermic Typic Calciustolls
Speck	Clayey, mixed, thermic Lithic Argiustolls
Stephen	Clayey, mixed, thermic, shallow Entic Haplustolls
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts
Vertel	Very-fine, montmorillonitic, thermic Udorthentic Chromusterts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs

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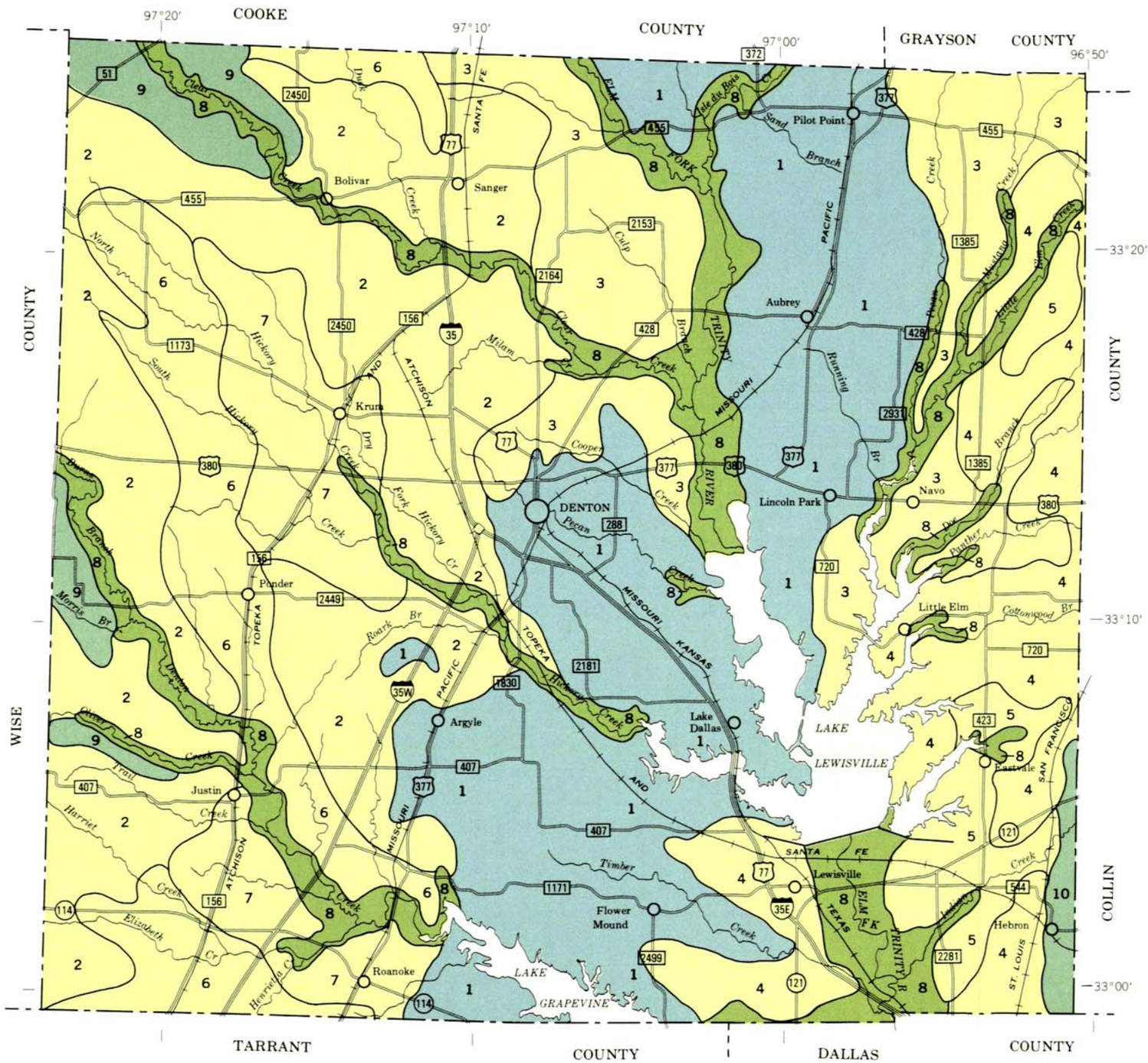


LEGEND*

MODERATELY DEEP AND DEEP SOILS ON UPLAND SAVANNAHS

1 — Birome-Gasil-Callisburg: Well drained, gently sloping to moderately steep, loamy soils that have moderate to slow permeability

MODERATELY DEEP AND DEEP SOILS ON UPLAND PRAIRIES

2 — Sanger-Somervell: Well drained, gently sloping to moderately steep, clayey and loamy soils that have moderate and very slow permeability

3 — Navo-Wilson: Well drained and somewhat poorly drained, nearly level to gently sloping, loamy soils that have very slow permeability

4 — Branyon-Burleson-Heiden: Well drained and moderately well drained, nearly level to moderately steep, clayey soils that have very slow permeability

5 — Altoga-Vertel-Ferris: Well drained, gently sloping to moderately steep, clayey soils that have moderate and very slow permeability

6 — Slidell-Sanger: Well drained, gently sloping to moderately steep, clayey soils that have very slow permeability

7 — Ponder-Lindale: Well drained, nearly level to gently sloping, loamy soils that have slow to very slow permeability

DEEP SOILS ON BOTTOM LANDS

8 — Frio-Ovan: Well drained and moderately well drained, nearly level, clayey soils that have moderately slow and very slow permeability

VERY SHALLOW TO DEEP SOILS ON UPLAND PRAIRIES

9 — Aledo-Somervell: Well drained, gently sloping to sloping, loamy soils that have moderate permeability

10 — Houston Black-Stephen: Moderately well drained and well drained, nearly level to gently sloping, clayey soils that have very slow and moderately slow permeability

* The texture noted in the descriptive headings applies to the surface layer of the major soils.

Compiled 1979

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

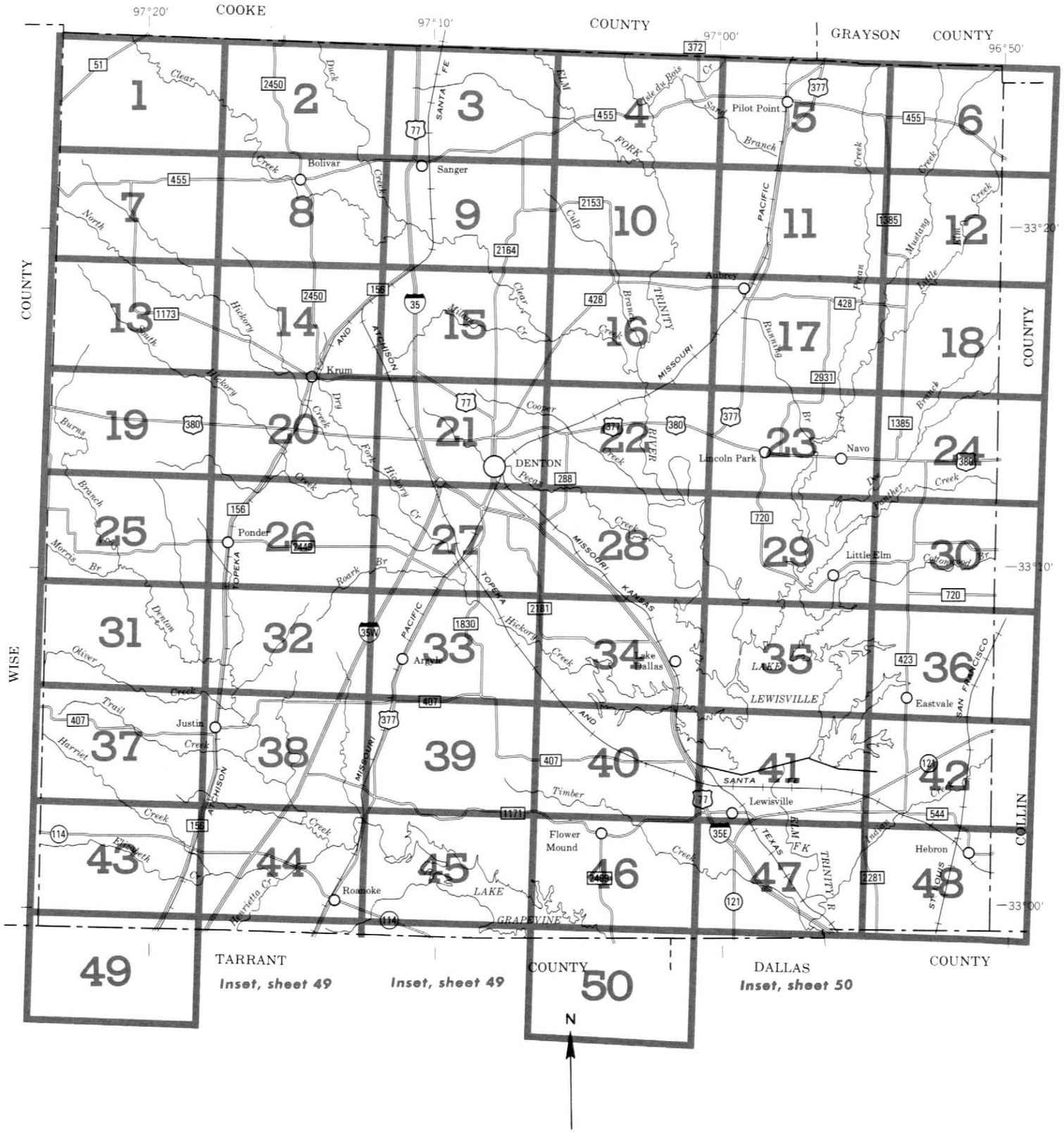
GENERAL SOIL MAP

DENTON COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km



Original text from each individual map sheet read:
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

DENTON COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water)
- Intermittent (int)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA, FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

SOIL LEGEND

The legend is numeric, soil names followed by the superscript 1/ are broadly defined units. The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to be to be interpreted for the expected use of the soils.

SYMBOL	NAME
1	Aledo association, undulating 1/
2	Altoga silty clay, 3 to 5 percent slopes
3	Altoga silty clay, 5 to 8 percent slopes
4	Altoga silty clay, 5 to 12 percent slopes, eroded
5	Aquilla loamy fine sand, 2 to 5 percent slopes
6	Arents, gently undulating 1/
7	Arents, hilly 1/
8	Aubrey fine sandy loam, 2 to 5 percent slopes
9	Bastrop fine sandy loam, 1 to 3 percent slopes
10	Bastrop fine sandy loam, 3 to 5 percent slopes
11	Birome fine sandy loam, 1 to 3 percent slopes
12	Birome fine sandy loam, 3 to 5 percent slopes
13	Birome-Rayex-Aubrey complex, 2 to 15 percent slopes
14	Birome-Rayex-Urban land complex, 2 to 12 percent slopes
15	Birome-Urban land complex, 1 to 5 percent slopes
16	Bolar clay loam, 1 to 3 percent slopes
17	Bolar clay loam, 3 to 5 percent slopes
18	Branyon clay, 0 to 1 percent slopes
19	Branyon clay, 1 to 3 percent slopes
20	Bunyan fine sandy loam, frequently flooded
21	Burleson clay, 0 to 1 percent slopes
22	Burleson clay, 1 to 3 percent slopes
23	Callisburg fine sandy loam, 1 to 3 percent slopes
24	Callisburg fine sandy loam, 3 to 5 percent slopes
25	Callisburg soils, 2 to 5 percent slopes, severely eroded 1/
26	Crockett fine sandy loam, 0 to 1 percent slopes
27	Crockett fine sandy loam, 1 to 3 percent slopes
28	Crockett-Urban land complex, 0 to 2 percent slopes
29	Eddy gravelly clay loam, 3 to 15 percent slopes
30	Energy fine sandy loam, frequently flooded
31	Ferris-Heiden clays, 3 to 5 percent slopes
32	Ferris-Heiden clays, 5 to 15 percent slopes
33	Frio silty clay, occasionally flooded
34	Frio silty clay, frequently flooded
35	Gasil fine sandy loam, 1 to 3 percent slopes
36	Gasil fine sandy loam, 3 to 8 percent slopes
37	Gasil-Urban land complex, 1 to 4 percent slopes
38	Gasil and Konsil soils, 1 to 5 percent slopes 1/
39	Gowen clay loam, occasionally flooded
40	Gowen clay loam, frequently flooded
41	Heiden clay, 1 to 3 percent slopes
42	Heiden clay, 3 to 5 percent slopes
43	Houston Black clay, 0 to 1 percent slopes
44	Houston Black clay, 1 to 3 percent slopes
45	Justin fine sandy loam, 0 to 1 percent slopes
46	Justin fine sandy loam, 1 to 3 percent slopes
47	Justin fine sandy loam, 3 to 5 percent slopes
48	Justin-Urban land complex, 0 to 3 percent slopes
49	Kaufman clay, frequently flooded
50	Konsil fine sandy loam, 1 to 3 percent slopes
51	Konsil fine sandy loam, 3 to 8 percent slopes
52	Lewisville clay loam, 1 to 3 percent slopes
53	Lewisville clay loam, 3 to 5 percent slopes
54	Lindale clay loam, 1 to 3 percent slopes
55	Lindale-Urban land complex, 1 to 5 percent slopes
56	Medlin-Sanger clays, 5 to 15 percent slopes
57	Medlin-Sanger stony clays, 5 to 12 percent slopes
58	Mingo clay loam, 1 to 3 percent slopes
59	Navo clay loam, 0 to 1 percent slopes
60	Navo clay loam, 1 to 3 percent slopes
61	Navo clay loam, 3 to 5 percent slopes
62	Navo-Urban land complex, 0 to 3 percent slopes
63	Ovan clay, occasionally flooded
64	Ovan clay, frequently flooded
65	Ponder loam, 0 to 1 percent slopes
66	Ponder loam, 1 to 3 percent slopes
67	Sanger clay, 1 to 3 percent slopes
68	Sanger clay, 3 to 5 percent slopes
69	Sanger-Urban land complex, 1 to 4 percent slopes
70	Seagoville clay, occasionally flooded
71	Silawa loamy fine sand, 2 to 5 percent slopes
72	Silstid loamy fine sand, 1 to 5 percent slopes
73	Silstid-Urban land complex, 1 to 5 percent slopes
74	Slidell clay, 1 to 3 percent slopes
75	Somervell gravelly loam, 1 to 5 percent slopes
76	Speck clay loam, 1 to 3 percent slopes
77	Stephen silty clay, 1 to 5 percent slopes
78	Trinity clay, occasionally flooded
79	Trinity clay, frequently flooded
80	Vertel clay, 1 to 3 percent slopes
81	Vertel clay, 3 to 5 percent slopes
82	Vertel clay, 5 to 12 percent slopes
83	Wilson clay loam, 0 to 1 percent slopes
84	Wilson clay loam, 1 to 3 percent slopes
85	Wilson-Urban land complex, 0 to 2 percent slopes

DENTON COUNTY, TEXAS — SHEET NUMBER 1

2 040 000 FEET

640 000 FEET

COOKE COUNTY

WISE COUNTY

(Joins sheet 2)

(Joins sheet 7)

2 060 000 FEET

625 000 FEET

N

2 Miles

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

DENTON COUNTY, TEXAS — SHEET NUMBER 2

(2)

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

0 0

¼ 1000

2000

¼ ½ 3000

¾ 4000

5000

2 095 000 FEET

640 000 FEET

COOKE COUNTY

Buck Creek

water

CLEAR CREEK

Duck Creek

Branch

water

Willow

water

(Joins sheet 1)

625 000 FEET

2 065 000 FEET

(Joins sheet 8)

(Joins sheet 3)


2,095,000 FEET
COOKE COUNTY
Pond
Creek
ELM FORK TRINITY RIVER
SANTA FE
Ranger
Branch
ATCHISON, TOPEKA AND
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
2,120,000 FEET
6,070,000 FEET
N
2 Miles
10000 Feet
5000
Scale 1:24000

DENTON COUNTY, TEXAS — SHEET NUMBER 4

4

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

0

0

¼

1000

½

2000

¾

3000

1

4000

1¼

5000

620 000 FEET

2 150 000 FEET

6 650 000 FEET

COOKE COUNTY

Johnson Branch

Isle du Bois Creek

Sand Branch

Pond Creek

ELM FORK TRINITY RIVER

(Joins sheet 3)

(Joins sheet 5)

2 125 000 FEET

(Joins sheet 10)

2 155 000 FEET
635 000 FEET
COOKE COUNTY
GRAYSON COUNTY
Pilot Point
Sand Branch
PACIFIC AND TEXAS
Pecan Creek
water
387
377
455
1385
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
2 180 000 FEET
620 000 FEET
N
2 Miles
10000 Feet
Scale 1:24000

N

2 Miles

10000 Feet

Scale 1:24000

GRAYSON COUNTY

COLLIN COUNTY

Mustang Creek

(Joins sheet 5)

(Joins sheet 12)

2185 000 FEET

2210 000 FEET

6320 000 FEET

6315 000 FEET

DENTON COUNTY, TEXAS — SHEET NUMBER 7

2 035 000 FEET

74

(Joins sheet 1)

7

N

6 070 000 FEET

WISE COUNTY

455

1173

Boom Creek

North Hickory Creek

(Joins sheet 8)

(Joins sheet 13)

2 060 000 FEET

2 Miles

10000 Feet

1

5000

Scale 1:24000

17

6 050 000 FEET

0 1000 2000 3000 4000 5000

DENTON COUNTY, TEXAS — SHEET NUMBER 8

8

N

Scale 1:24000

2 Miles 10000 Feet

1 5000

(Joins sheet 2)

(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 14)

2 090 000 FEET

620 000 FEET

605 000 FEET

2 065 000 FEET

CLEAR CREEK

Clear Creek

Duck Creek

Boom Creek

Bolivar

water

2450

455

2 095 000 FEET

6 20 000 FEET

54

(Joins sheet 3)

Sanger

ATCHISON, TOPEKA AND SANTA FE

Ranger Branch

Duck Creek

CLEAR CREEK

Morris Branch

water

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

2 120 000 FEET

600 000 FEET

N

2 Miles

10 000 Feet

1

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

DENTON COUNTY, TEXAS — SHEET NUMBER 10

10

N

Scale 1:24000

2 Miles 10000 Feet

1 5000

¾ 4000

½ 3000

¾ 2000

0 1000

0

(Joins sheet 4)

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 16)

2 150 000 FEET

2 125 000 FEET

600 000 FEET

16 500 FEET

ELM FORK TRINITY RIVER

Culp Branch

Bray Branch

FLOOD POOL LINE

water

2153

DENTON COUNTY, TEXAS — SHEET NUMBER 11

2 155 000 FEET

(Joins sheet 5)

615 000 FEET

PACIFIC

Branch

TEXAS

Creek

Pecan

water

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

2 180 000 FEET

600 000 FEET

11

N

2 Miles

10 000 Feet

Scale 1:24 000

DENTON COUNTY, TEXAS — SHEET NUMBER 12

12

N

(Joins sheet 6)

64

2 210 000 FEET

615 000 FEET

(Joins sheet 11)

2 Miles

10000 Feet

Scale 1:24000

5000

4000

3000

2000

1000

0

1

¾

½

¼

0

600 000 FEET

Creek

Mustang

Elm

Little

Creek

1385

COUNTY

COLLIN

32

61

2 185 000 FEET

(Joins sheet 18)

DENTON COUNTY, TEXAS — SHEET NUMBER 13

13

2 035 000 FEET

(Joins sheet 7)

600 000 FEET

COUNTY

WISE

North

Hickory

Creek

South

Hickory

Creek

Buns

Branch

water

1173

(Joins sheet 14)

(Joins sheet 19)

2 060 000 FEET

N

2 Miles

10000 Feet

5000

1

Scale 1:24000

0

1000

2000

3000

4000

5000

1/4

1/2

3/4

1

2 085 000 FEET

14

N

Scale 1:24000

2 Miles 0 1

10000 Feet 5000 0

(Joins sheet 8)

(Joins sheet 13)

2 090 000 FEET

600 000 FEET

2 085 000 FEET

2 065 000 FEET

(Joins sheet 20)

(Joins sheet 15)

Dalton Junction

Moores Branch

Hickory Creek

North Creek

Jordan Creek

Dry Fork Creek

SANTA FE

TOPEKA

AND

MISSOURI

KANSAS

TEXAS

ATCHISON

water

2450

1173

156

35

DENTON COUNTY, TEXAS — SHEET NUMBER 15

2 095 000 FEET

(Joins sheet 9)

600 000 FEET

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 21)

2 120 000 FEET

80 000 FEET

15

N

2 Miles

10000 Feet

Scale 1:24000

Moores Branch

CLEAR CREEK

Milam Creek

water

MKT

16

N

(Joins sheet 10)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 22)

2 150 000 FEET

2 125 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000

ELM FORK FLOOD POOL LINE

TRINITY RIVER FLOOD POOL LINE

Culp Branch

CLEAR CREEK FLOOD

PACIFIC AND TEXAS

water

428

N

2 155 000 FEET

(Joins sheet 11)

540 000 FEET

Aubrey

Spring Hill

Running Creek

Pecan Creek

Elm Creek

Little Elm

Camrell Branch

Slough

water

TEXAS AND PACIFIC

428

377

2931

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 23)

2 180 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000

18

N

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000

(Joins sheet 12)

(Joins sheet 17)

(Joins sheet 24)

2 210 000 FEET

2 185 000 FEET

580 000 FEET

590 000 FEET

COLLIN COUNTY

Creek

Mustang

water

Little

Elm

water

water

Branch

Doe

2 035 000 FEET

(Joins sheet 13)

19

N

2 Miles

10000 Feet

(Joins sheet 20)

Scale 1:24000

5000

1

0

1000

2000

3000

4000

5000

2 060 000 FEET

(Joins sheet 25)

2 060 000 FEET

480 000 FEET

COUNTY

WISE

Branch

South Hickory Creek

Cow Branch

Burns Ft

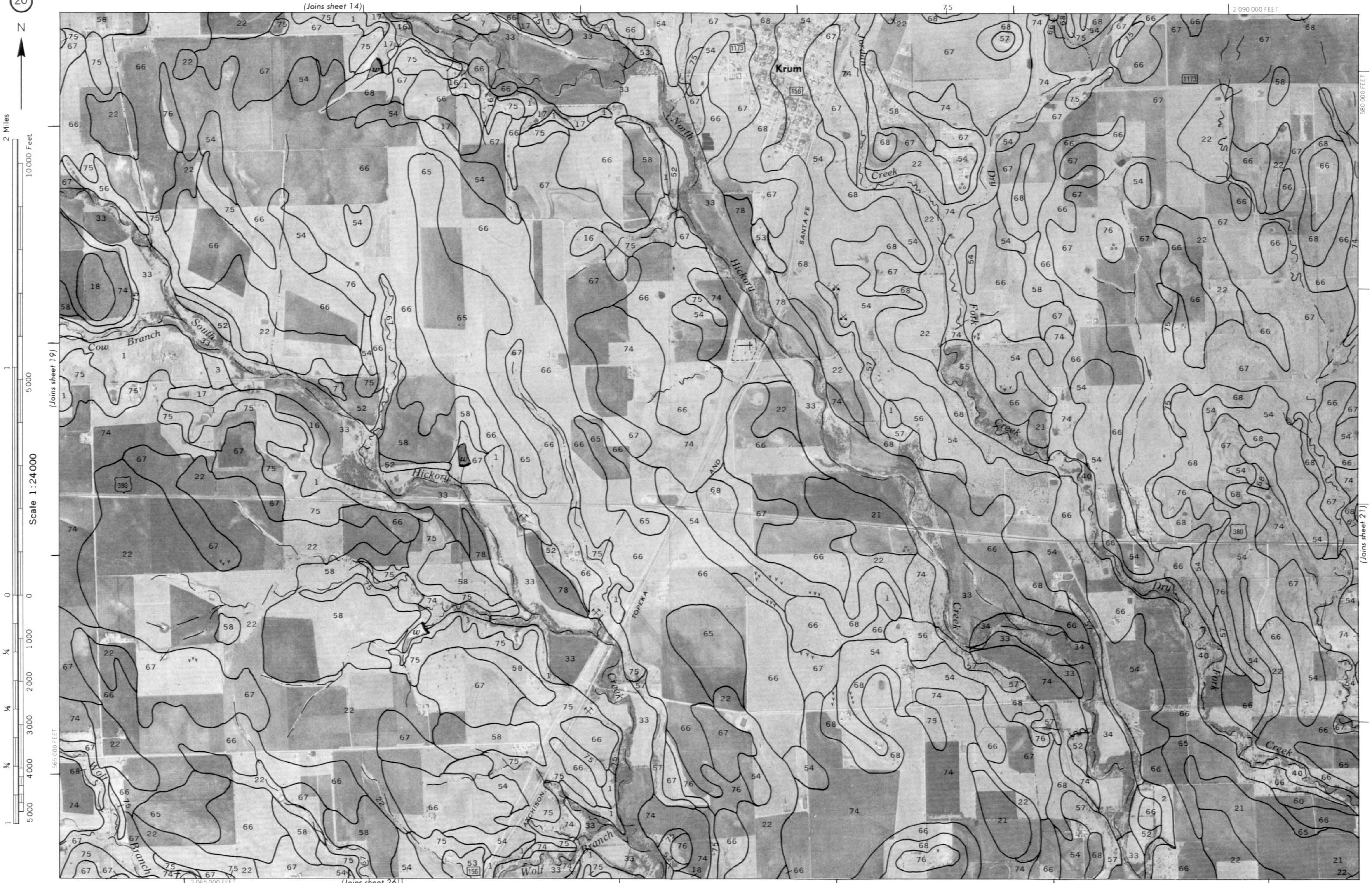
Denton Creek

Stony

Wolf Branch

380

2622


20
N
(Joins sheet 14)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 26)
Krum
North
Hickory
South
Cow Branch
Hickory
Creek
Dry Fork Creek
Dry Fork Creek
Wolf Branch
Wolf Branch
Creek
SANTA FE
AND
TOPEKA
ATCHISON
1173
156
380
2 090 000 FEET
580 000 FEET
2 065 000 FEET
565 000 FEET
Scale 1:24 000
2 Miles
1
0
10 000 Feet
5000
0
1000
2000
3000
4000
5000
1 Kilometer
1/4
1/2
3/4

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 27)

2,095,000 FEET

580,000 FEET

2,120,000 FEET

21

N

2 Miles

10,000 Feet

Scale 1:24000

DENTON
(county seat)

SITE NO. 17A

SITE NO. 16

Cooper Creek

Pecan Creek

Dry Fork Creek

MISSOURI

KANSAS

TEXAS

PACIFIC

TEXAS

N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 5000

(Joins sheet 16)

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 28)

2 150 000 FEET

2 125 000 FEET

565 000 FEET

525 000 FEET

Cooper Creek

TEXAS

Cooper

Pecan Creek

Timber Branch

AND PACIFIC

RIVER

TRINITY

FORK

ELM

water

LAKE LEWISVILLE

New Hope

FLOOD POOL LINE

380

377

288

DENTON COUNTY, TEXAS — SHEET NUMBER 23

2 155 000 FEET

675 000 FEET

Running Slough

Cantrell Creek

Pecan Creek

Elm Fork

Little Elm

Doe Branch

LAKE LEWISVILLE

New Hope

Navo

FLOOD POOL LINE

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 29)

2 180 000 FEET

660 000 FEET

23

N

Scale 1:24000

2 Miles

10000 Feet

24

N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0

(Joins sheet 18)

(Joins sheet 23)

(Joins sheet 30)

2 210 000 FEET

575 000 FEET

2 185 000 FEET

960 000 FEET

COLLIN COUNTY

Doe Branch

Panther Creek

FLOOD POOL LINE

water

DENTON COUNTY, TEXAS — SHEET NUMBER 25

25

N

2 035 000 FEET

560 000 FEET

(Joins sheet 19)

(Joins sheet 26)

(Joins sheet 31)

2 060 000 FEET

545 000 FEET

WISE COUNTY

DENTON

CREEK

MORRIS

BRANCH

Ponder

water

2622

2449

Scale 1:24 000

2 Miles

10 000 Feet

5 000

26

N

Scale 1:24000

2 Miles 1

10000 Feet 0 1000 2000 3000 4000 5000

(Joins sheet 20)

2 090 000 FEET

560 000 FEET

(Joins sheet 25)

(Joins sheet 27)

2 065 000 FEET

(Joins sheet 32)

Wolf Branch

South Hickory Creek

North Hickory Creek

DENTON AIRPORT

Ponder

SANTA FE

AND

TOPEKA ATCHISON

Roark Branch

water

2449

156

DENTON COUNTY, TEXAS — SHEET NUMBER 27

2 095 000 FEET

(Joins sheet 21)

560 000 FEET

DENTON
(county seat)

DENTON AIRPORT

Dry Hickory Creek

MISSOURI PACIFIC

KANSAS TEXAS

Minchin

Jagoe

Fletcher Branch

Roark Branch

Hickory Creek

Water

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 33)

2 120 000 FEET

545 000 FEET

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

28

N

Scale 1:24000

2 Miles 0 1 Miles

10000 Feet 0 5000

(Joins sheet 22)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 34)

2 150 000 FEET

560 000 FEET

545 000 FEET

2 125 000 FEET

Carter

Pecan Creek

ELM FORK TRINITY RIVER

Cantrell Slough

FLOOD POOL LINE

LAKE LEWISVILLE

Camp Copass

Shady Shores

water

MISSOURI

KANSAS

TEXAS

288

35E

DENTON COUNTY, TEXAS — SHEET NUMBER 29

29

N

2 155 000 FEET

560 000 FEET

(Joins sheet 23)

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 35)

2 180 000 FEET

540 000 FEET

Cantrell Slough

Doe Branch

Cottonwood Branch

LAKE LEWISVILLE

Little Elm

720

2 Miles

10 000 Feet

Scale 1:24 000

(Joins sheet 24)

2 210 000 FEET

555 000 FEET

N

2 Miles

10 000 Feet

Scale 1:24 000

(Joins sheet 29)

540 000 FEET

2 185 000 FEET

(Joins sheet 36)

COLLIN COUNTY

Panther Creek

FLOOD POOL LINE

Cottonwood Branch

FLOOD POOL LINE

2934

423

720

2 035 000 FEET

(Joins sheet 25)

7 240 000 FEET

WISE COUNTY

DENTON

Oliver Creek

Drop

CREEK

1384

(Joins sheet 32)

(Joins sheet 37)

2 060 000 FEET

7 225 000 FEET

31

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1 000 2000 3000 4000 5000

32

N

2 Miles

10000 Feet

5000

1

Scale 1:24000

0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

(Joins sheet 26)

2 090 000 FEET

540 000 FEET

(Joins sheet 31)

(Joins sheet 33)

525 000 FEET

2 065 000 FEET

(Joins sheet 38)

Hog

SANTA FE

Branch

AND

TOPEKA

Denton

ATCHISON.

Creek

Graham

Branch

156

1384

2 095 000 FEET

2 120 000 FEET

540 000 FEET

(Joins sheet 27)

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 39)

N

Scale 1:24000

2 Miles

10000 Feet

5000

Argyle

Hickory Creek

Missouri Branch

Fletcher Branch

Pacific Railroad

Grapevine Branch

Fincker Branch

Loving Branch

Texas Electric Railway

Missouri Kansas Texas Railroad

Flood Pool Line

water

1830

377

35W

407

34

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 28)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 40)

2 150 000 FEET

540 000 FEET

525 000 FEET

2 125 000 FEET

Corinth

Shayham Point

LAKE LEWISVILLE

Graveyard Slough

Sharon Lake

Hickory Creek

Camp Dallas

Hidden Hill

Harbor Grove

Lake Dallas

LAKE LEWISVILLE

Bryant Branch

Hickory Creek

Pondexter Branch

FLOOD

POOL

LINE

MISSOURI

KANSAS

TEXAS

(Joins sheet 29)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 41)

2 150 000 FEET

540 000 FEET

520 000 FEET

2 175 000 FEET

LAKE LEWISVILLE

Camp Lucille

GARZA-LITTLE ELM RESERVOIR

FLOOD POOL LINE

35

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 30)

(Joins sheet 35)

(Joins sheet 42)

2 205 000 FEET

2 180 000 FEET

535 000 FEET

520 000 FEET

N

Scale 1:24000

2 Miles 0 1

10000 Feet 5000 0

¼ ⅓ ¾

1000 2000 3000 4000 5000

LAKE LEWISVILLE

FLOOD POOL LINE

Stewart Creek

SAN FRANCISCO

ST LOUIS

COUNTY

COLLIN

2 035 000 FEET

(Joins sheet 31)

37

N

520 000 FEET

Oliver Creek

Trail

Justin

407

WISE COUNTY

Harriet Creek

Creek

Catherine Branch

(Joins sheet 38)

(Joins sheet 43)

2 060 000 FEET

2 Miles

10000 Feet

Scale 1:24000

5000

0

1000

2000

3000

4000

5000

1

¼

½

¾

1

505 000 FEET

38

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000 FEET

(Joins sheet 32)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 44)

2 090 000 FEET

2 065 000 FEET

505 000 FEET

520 000 FEET

Oliver Creek

SANTA FE

DENTON CREEK

Justin

AND

Trail

TOPEKA

Creek

ATCHISON

Catherine

Branch

FLOOD POOL LINE

Cleveland Branch

water

Graham Branch

PACIFIC AND TEXAS FLOOD POOL LINE

Smoots

156

407

35W

(39)

2 095 000 FEET

(Joins sheet 33)

7 020 000 FEET

PACIFIC

Branch

Loving Branch

Branch

Poindexter

Bartonville

Whites

water

Timber Creek

Sharps Branch

TEXAS

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 45)

2 115 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

40

N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 1000 2000 3000 4000 5000

(Joins sheet 34)

(Joins sheet 39)

(Joins sheet 41)

(Joins sheet 46)

2 150 000 FEET

2 120 000 FEET

905 000 FEET

520 000 FEET

LAKE LEWISVILLE

Highland Village

LAKE LEWISVILLE

Poindexter Branch

FLOOD POOL LINE

MISSOURI

KANSAS

TEXAS

water

Timber Creek

Prairie Creek

407

35E

1171

2 150 000 FEET

520 000 FEET

(Joins sheet 35)

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 47)

2 175 000 FEET

N

2 Miles

10 000 Feet

5 000

Scale 1:24000

50 000 FEET

LAKE

LEWISVILLE

LAKE

LEWISVILLE

MISSOURI

KANSAS

TEXAS

Stewart Creek

McWhorter Creek

Prairie Creek

Midway Branch

ELM FORK TRINITY RIVER

FLOOD

POOL

LINE

TEXAS

LEWISVILLE

42

N

Scale 1:24000

2 Miles 10000 Feet

1 5000

(Joins sheet 36)

(Joins sheet 41)

2 205 000 FEET

515 000 FEET

505 000 FEET

2 180 000 FEET

(Joins sheet 48)

(Joins sheet 43)

LAKE LEWISVILLE

FLOOD POOL LINE

Office

Creek

McWhorter Creek

Indian Creek

MISSOURI KANSAS TEXAS

SAN FRANCISCO & ST LOUIS

Camey

DENTON COUNTY

COLLIN COUNTY

423 544 121

DENTON COUNTY, TEXAS — SHEET NUMBER 43

2 035 000 FEET

(Joins sheet 37)

505 000 FEET

Harriet Creek

Elizabeth Creek

SANTA FE

ANO

TOPEKA

ATCHISON

WISE COUNTY

(Joins sheet 44)

(Joins sheet 49)

2 060 000 FEET

485 000 FEET

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

(Joins sheet 38)

(Joins sheet 43)

(Joins sheet 45)

(Joins inset A, sheet 49)

2 090 000 FEET

500 000 FEET

2 060 000 FEET

485 000 FEET

N

Scale 1:24000

2 Miles 1

10000 Feet 5000

0 0

¼ ¼ 1000

½ ½ 2000

¾ ¾ 3000

1 1 4000

5000

Catherine Branch

ATCHISON TOPEKA AND SANTA FE

DENTON CREEK

Graham Branch

Denton Creek

FLOOD POOL LINE

Harriet Creek

Elizabeth Creek

Elizabethtown

Henrietta Creek

water

PACIFIC

TEXAS

Elizabeth Creek

Cade Branch

Roanoke

DENTON COUNTY, TEXAS — SHEET NUMBER 45

2 090 000 FEET

500 000 FEET

(Joins sheet 39)

(Joins sheet 44)

(Joins sheet 46)

(Joins inset B, sheet 49)

2 115 000 FEET

485 000 FEET

N

2 Miles

10000 Feet

1

5000

Scale 1:24000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

PACIFIC AND TEXAS

Denton Creek

White Rock Branch

Sharps Branch

Marshall Branch

FLOOD POOL LINE

GRAPEVINE LAKE

water

Westlake

46

N

(Joins sheet 40)

2 145 000 FEET

500 000 FEET

(Joins sheet 45)

(Joins sheet 47)

Flower Mound

Timber Creek

Baker's Branch

DENTON CREEK

GRAPEVINE LAKE

water

FLOOD LINE

FLOOD LINE

2499

3040

2 120 000 FEET

(Joins sheet 50)

2 Miles 10000 Feet

Scale 1:24000

1 5000 0 0 1000 2000 3000 4000 5000

DENTON COUNTY, TEXAS — SHEET NUMBER 47

47

N

2 150 000 FEET

500 000 FEET

(Joins sheet 41)

(Joins sheet 46)

(Joins sheet 48)

(Joins inset, sheet 50)

2 175 000 FEET

485 000 FEET

LEWISVILLE

Timber Creek

MISSOURI

ELM FORK

Midway Branch

water

TRINITY RIVER

Indian Creek

TEXAS

Dudley Branch

Denton Creek

INDEFINITE BOUNDARY

DALLAS COUNTY

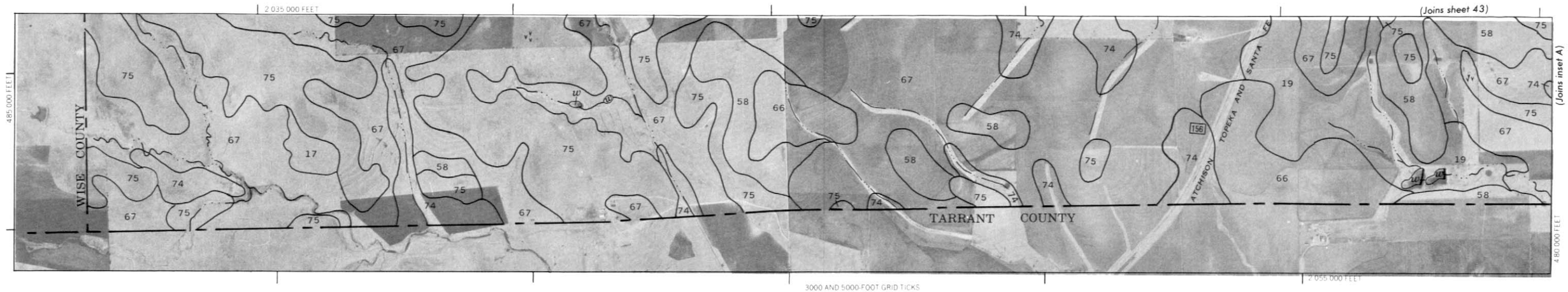
2 Miles

10000 Feet

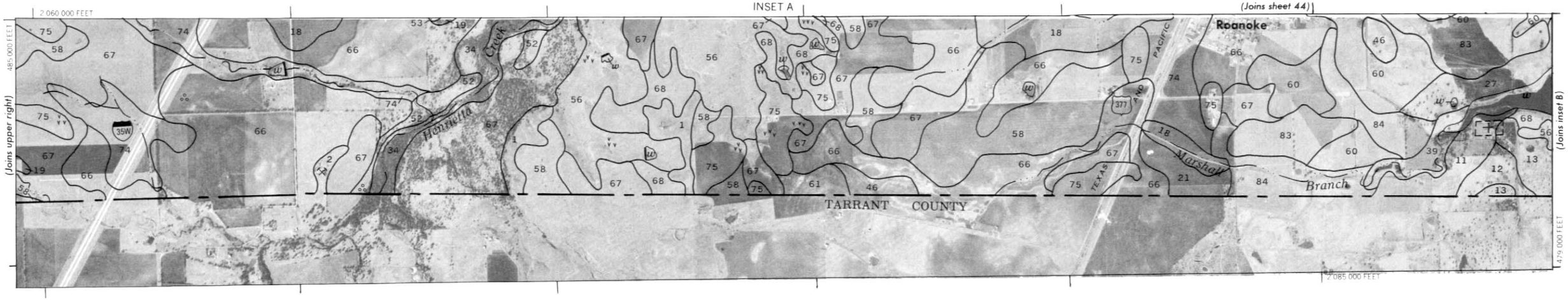
Scale 1:24000


48
N
Scale 1:24000
(Joins sheet 42)
(Joins sheet 47)
2 180 000 FEET
2 205 000 FEET
485 000 FEET
495 000 FEET
Indian Creek
Dudley Branch
Furneaux Creek
Hebron
MISSOURI KANSAS TEXAS
SAN FRANCISCO
ST. LOUIS SAN
COLLIN COUNTY
DALLAS COUNTY
INDEFINITE BOUNDARY
water
2281
545
77

DENTON COUNTY, TEXAS — SHEET NUMBER 49

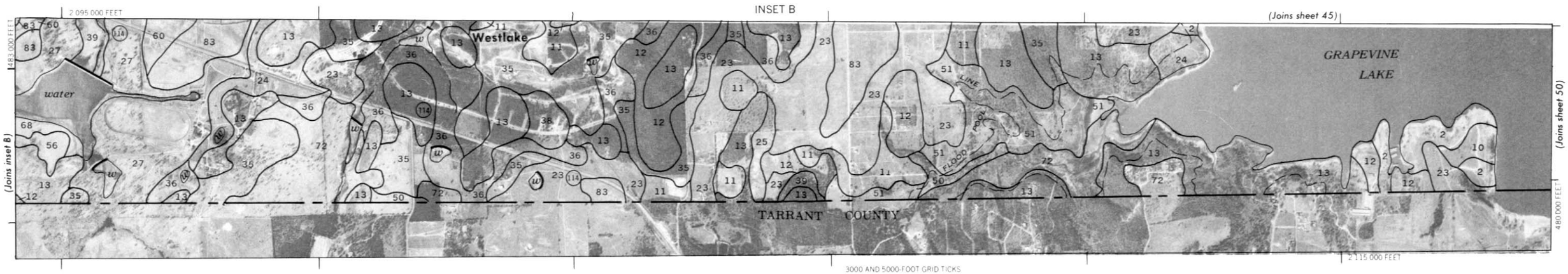


INSET A



2000 AND 5000-FOOT GRID TICKS

INSET B



3000 AND 5000-FOOT GRID TICKS

49

N

2 Miles

10 000 Feet

Scale 1:24 000

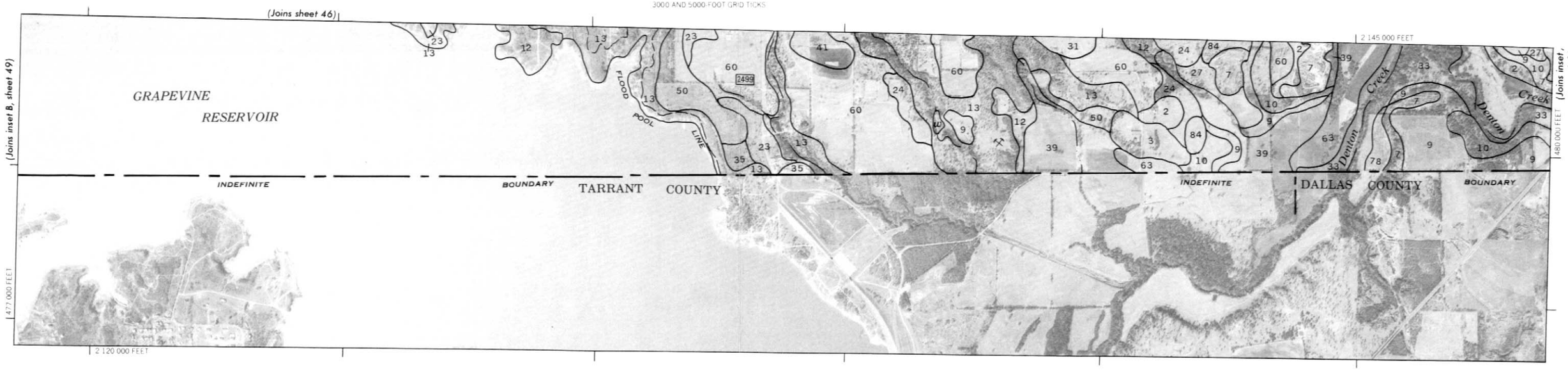
50

N

Scale 1:24000

2 Miles 10000 Feet 1 5000 0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

3000 AND 5000-FOOT GRID TICKS



1000 AND 5000-FOOT GRID TICKS